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EDMUND RUFFIN, EDITOR AND PROPRIETOR.

From the Transactions of the Highland Society.

ON AN IMPROVED METHOD OF MAKING CLOVER-HAY.

The three following articles are from the last (June) No. of the Transactions of the Highland and Agricultural Society of Scotland, and two of them were honored by premiums conferred by the Society. The climate of Scotland is as remarkable for being cool and moist, as ours is for being hot and dry in summer; and therefore the details of the process of haymaking ought to be generally very different. Still, it is interesting to know what are deemed new and useful improvements in other countries, and we may often profit by them, notwithstanding the difference of circumstances, provided, we always take care to keep that difference in view; and without that care, we may often err, and suffer loss, by following the example of our nearest neighbors. Besides, however different the *means* may be, the *end* sought in haymaking is the same every where—and that is, to evaporate the mere water, and preserve the rich portion of the juices of the grass—and for these purposes it is desirable to have as much exposure of the curing grass to air, as possible, and as little exposure as possible to sun and wet.—ED. FAR. REG.

[Hay-making is perhaps the worst conducted operation in Scottish husbandry, and the object of the Society in offering premiums for essays on the best method of making both clover and meadow hay, is to urge the general adoption of a superior management in securing the crop of that valuable and nutritious winter provender. It is to be hoped that the success attained by the writers of the following essays will prompt other haymakers to adopt the practice described by them. A premium of ten sovereigns was awarded for this essay.]

By Mr. John Proudfoot, Inveresk.

The present practice of making hay in the neighborhood where I reside, (and, I believe, it is much the same throughout Scotland) is liable to many objections. The chief of these are, first, that of allowing the the grass to be "too ripe," as it is generally called, before it is cut. Second, allowing the grass to be on the ground till it be either rotted with bad weather, drenched with rain, or dried up by too long exposure to the sun.

The method I have adopted for the last three years is very simple, but, in my opinion, a very secure one for our changeable climate. It is as follows:—This year (1836) I commenced cutting a field of grass of ten acres, on the first of July, just when the flower was going off the rye-grass, which I conceive to be the true criterion for cutting. This field was sown down with 12 lbs. of the best Dutch red clover, and 1 lb. of white ditto, with two and a half pecks of best Ayrshire annual rye-grass per imperial acre. It was a most excellent crop, and, as quick as five men could cut it down, women put it up close behind them in the following manner:—taking hold of the grass by the top, and placing it neatly round the left foot, keeping the foot *steady* in the heart of the handful, then tying a little band round the top, to keep it steady in the upright conical position, and when the foot is removed the aperture serves for a ventilator. Thus, nearly all the surface of the grass is exposed to the air, and if the hollow cones are neatly put up, they will be almost safe from the weather, as, in case of rain, it runs off as fast as it falls.

If the weather is at all favorable, the conical-handfuls will be ready, in twenty-four hours, for turning out, and putting up into small cocks the same day; but they may, with greater safety, be allowed to remain in the first position until ready for putting up into large cocks. I am of opinion that the less turning clover-hay gets, the better, as the oftener it is turned, its value is deteriorated, more especially after getting rain.

One-half of the field was turned out of the handfuls, the other half allowed to remain until it was ready for being put into cocks, and my manner of making cocks is this:—A man stands at the cock, to whom the women bring the handfuls, which he puts neatly up, always keeping the tops of them to the centre of the cock, in a direction sloping upwards from him, so as the slope may throw off the rain. In thus carefully constructing the cock, little vacuities will be left *between* the handfuls to act as ventilators, the influence of which will very soon render it proper to put the hay into larger cocks. In one week I had all the hay of the ten acres put into ricks of 130 or 140 stones, in which state I conceived it to be proof against any kind of weather,—indeed, were it not that purchasers were expected to take it "*off the rick*," it might have been put into the stack. I may mention, that the rain fell less or more almost every day, excepting on Sunday the third, and Monday the fourth, but on the fifth there was a severe thunder-storm, *and, notwithstanding this most unpropitious weather, I made nearly* 4000 *stones of hay in the finest condition, in one week from the time it was cut; and as to its quality,* I think I am not too bold, when I say, that I am not afraid to challenge the county of Edinburgh.*

The great advantage of this system over the common one in a bad season is, that one hour's sunshine will have more effect in drying the hay than a whole day. I have this year seen hay lying on the ground for weeks together, and the aftermath growing up through it, which is destructive both to the hay and the second crop; but if the system which I have described *be followed out*, I will venture to say that the hay will not only be infinitely superior, *but in the end will be put up at less ex-*

*Testimonials of the superior quality of the hay were furnished to the Society by the author, from Sir John Hope, of Pinkie, and William Aitchison, Esq. younger of Drummore.—ED.

pense than in the old system, under the most favorable circumstances.

I have also converted the second crop into hay over the same ground with equal success, notwithstanding the bad weather, and all the obstacles incidental to making a second crop of good hay.

From the same.

ON AN IMPROVED METHOD OF MAKING MEADOW-HAY.

By Mr. John Irving, Farm-Overseer at Closeburn Hall, Dumfries-shire.

[The Society's Silver Medal was awarded for this Essay.]

It is too much the prevailing opinion in Scotland, that meadow-hay cannot be secured there as effectually as it is in England. The cause of this prevalent opinion, it is apprehended, is the want of knowledge in the art of making meadow-hay. The usual practice of making every kind of hay in Scotland is, to allow the grass to stand too long before it is mowed, and in the case of meadow-hay until August, when the seeds of the grasses are nearly ripe, and the stalks have lost almost all their succulency; and to allow the swath to lie for some days till a considerable part of its moisture is evaporated. The cut crop is then shaken out and turned over when it again lies for some days till it is thought sufficiently dry for putting into large cocks. The hay frequently remains in these cocks, in the field, for two or three months. It is then carried and made into a stack, when it is expected that no fermentation will take place, Scotch farmers imagining that fermentation in hay should always be avoided.

A method of making hay similar to that practised in England has been adopted by C. G. Stuart Menteath, esq., of Closeburn, by whom I have been employed for some years past as farm-overseer. This method practised over an extent of water meadow, (chiefly consisting of peat-moss of 20 feet in depth, and upwards of 100 imperial acres in extent,) is to cut the grass as early in July as the weather will permit. The grass mowed in the morning before twelve o'clock, is carefully shaken out upon the ground by hand, and that mowed after twelve o'clock is allowed to remain in the swath till next morning, when it is likewise shaken out. If the weather is at all dry, the hay that has been shaken out is always put into small cocks for the night, so that the ground may be sooner dry the next morning to receive the hay for its exposure to the sun; and after two dry sunny days' exposure, it is frequently, and always upon the third day, carried to the hay-barn, where it undergoes a trifling fermentation, which is a desirable process when hay is made with its natural juices. If the weather prove rainy, the hay should remain in the small or hand cocks till a dry day allow of its being shaken out, and, in the evening, carried to the hay or Dutch barn. This barn is formed of larch poles, set upright, 15 or 18 feet in height, including a space of 15 feet in breadth and 60 in length, and supporting a light roof of thin boards, or a slight covering of straw stitched upon the rafters. No person who expects to have good meadow-hay should be without such a Dutch barn. Salt is generally sprinkled amongst the hay, when it is packing up in the hay barn, in the proportion of about 16 lbs. to the ton; and, should the hay have been exposed to much wet weather, a double quantity will be advisable.—Hay has thus been made here, under my directions, for many years, without a single ton of it ever having been spoiled.

From the same.

ON MAKING MEADOW-HAY.

By Patrick Miller, Esq., late of Dalswinton, Dumfries-shire.

Making hay is universally allowed to be one of the most important branches of agricultural pursuits, but the principle on which it should be conducted is not at all understood on this side of Tweed.

In England, however, the operation is very differently performed, and with very different and more satisfactory results; for by their system, a great deal of time is saved at a critical period, and a far superior article of food for their animals is produced.

Besides the great and necessary despatch which is used in England, much skill is also employed to produce and maintain a requisite degree of heat or fermentation in the stack, when the hay is put up, in order to convert the juice of the herbage to a saccharine state, which is found to be both more palateable, and likewise more nutritious for all beastial that is fed upon it.

In Scotland, on the other hand, it would almost seem as if diligence was employed to unnecessarily procrastinate the work, and subject it to the risk of unfavorable changes of the weather; and by the excessive bleaching and drying of the grass, which is so universally practised, it is deprived of the possibility of assuming the saccharine quality; and what sap is permitted to remain in it, is converted to starch, which is neither so agreeable nor nourishing for horses, as hay made upon the principle which I am anxious to recommend, and from whence arises, as is easily to be perceived, a greater waste of hay in Scotch than in English stables.

Having premised this much, I proceed to detail the practice which I have pursued for many a bygone year on my farm, which, being on a limited scale, I shall therefore confine my description to the narrow compass of my own operations, but which, of course, easily admits of being extended to a larger field, as circumstances may require.

When the hay season arrives and the weather is favorable, and when I perceive, by the height of the column of mercury in the barometer, and likewise from the appearance of the skies, that there is a likelihood of its continuing so, I set a couple of mowers to work very early in the morning, each attended by a boy or girl about twelve or thirteen years of age, and, as soon as the men have made half a dozen cuts of the scythe, the two boys or girls take up the swath and shake it out as thin as possible on the ground where it grew, there to lie and wither till after breakfast.

On the return of the mowers from their breakfast, a stout active woman begins to turn with a rake, *in the direction of the sun*, the grass which was first shaken out, the men and the boys cutting

down and shaking out in the same way as in the morning.

When the woman has finished turning the early cut grass, she immediately goes to the spot where she began, and shakes all out again as thin as she can, and when finished, she commences turning by large rakefulls where the mowers resumed their work after breakfast, and continues her task in the same manner as when she began in the morning, always turning as already said *in the direction of the sun.*

On the people returning to the field from their dinner, the two boys immediately begin to shake out that part of the second turned grass which had not been accomplished before going to dinner, and when that is finished, they commence turning what was last cut, and then shake it all out again.

At this period, the two mowers and the woman proceed to rake the first cut hay into what is called a wind-row, and one of the men commences with a pitchfork to put it into cocks of about 10 or 12 stones weight, and between five and six feet in height, *but on no account, is a foot permitted to go upon it, for it cannot be put up too light;* neither is it to be roped, for if the weather is calm, a few hours after it is in the cock it will so compact itself, that it will require a very violent wind to overturn it.

Thus, the hay which was cut in the course of the day will be, through this mode of treatment, sufficiently dried and secured by the evening against any change of weather which may occur in the course of the night, and it will stand exposure to the storm fully as well as the hay which is so sadly mismanaged by the improper system at present in use.

So far the process only relates to getting quit of the redundant sap in the herbage, but if the hay gets rain or any adventitious moisture, either in working or stacking, it must be carefully dried off before being put into the stack; or so brisk a fermentation will ensue, that combustion will infallibly take place.

The next part of the operation is stacking the hay, and this may take place, if the weather continues fine, on the second or third day after the last cock was put up.

In making this kind of hay, the great and important object is to get it to ferment or heat in the stack, for the purpose of making it evolve its saccharine quality, as in the malting of grain, and is effected as follows:

If a round stack is intended, let a common sack be well crammed full of hay or straw, and placed erect on the foundation where the stack is to be reared, and then begin building all around it with the first cut cocks, intermixing now and then a few of those last put up, in order to promote the fermentation; and when the stack gets as high as the top of the bag, the worker pulls it straight upwards, and so continues working around and pulling it up till the stack is finished, and in this way a chimney is formed for the escape of the nascent gas.

Should a long stack be preferred, then a chimney must be brought out at the peak at each end, and one in the middle, by the same means, if a large mass of hay is put in the stack; and in conclusion, I recommend that these vents shall not be closed for a month, or while any perceptible fermentation is going on.

From the Southern Agriculturist.

THE ERRORS OF A CULTIVATOR OF THE VINE.

So much has been written on this subject, and by so many who knew nothing about it, that it is not wonderful, a novice like myself should have been led into many radical mistakes. My experiments, trifling as they are, may induce others to follow in my steps, and if they act for themselves, light may be thrown upon one of the most innocent, rational and interesting amusements, that an old man can take up with.

Amongst the employments for the summer in a lonesome neighborhood near the mountains of South Carolina, I undertook to cultivate the vine in my garden. I had never seen the process, although I had read many books on the subject, and the impression on my mind was, that if trained at a height of ten or twelve feet, success would probably attend my efforts.

To gain this height as speedily as possible, as soon as the cuttings began to shoot out the second year, I turned my attention altogether to gaining height. For this purpose, I kept down every lateral shoot, and training the leading one carefully up a post, I succeeded that year in reaching, in some cases, a height and length of stem that very much surprised me. I was not prepared to take advantage of the rapid growth, for I had no arbor raised to receive my vines, nor even a good espalier. With almost back-country thriftlessness, I patched up, what I was forced to call "*a sort of a contrivance,*" by way of espalier, and on this my vines got so fixed that I could not extricate them, to prepare for next year.

Early the third year, I prepared to make at least a small crop of grapes. The few shoots, I had left on the vines, more by accident than design, I trimmed down to one, and occasionally two eyes. I had read that each eye would produce me a bunch of grapes, and I knew from experience in other agricultural matters, *that a very small crop would be likely to be well tended!* I, therefore, left as few chances as might be, of the vines bringing more grapes than were necessary.

As the spring advanced, I got deeply interested in this new occupation, and there being a much larger and finer crop, than I could have expected, without inquiring into the cause of this, my special attention was called to prevent the rot, or dropping of the fruit.

Reasoning from my slender experience in this culture, it struck me that nature, in giving the immense luxuriance to vines, had some other object in view, than merely producing wood and superabundant shoots; that probably if this luxuriancy was not kept down, I should, in gaining size in my vines, lose my grapes by the rot; whereas, if the growth of the vine was entirely kept under, the extra nourishment would be directed into the right channel, and strengthen and ripen all the fruit I had on them.

My success was complete; as fast as a shoot or a leaf put out, near or on the fruit stems, I pinched them off with my nails while they were tender, and cut off every one of the long shoots but one. My watchfulness was excited by continued success, and I had the gratification to see every bunch of fruit hastening to maturity, with scarcely the loss of a single grape.

Confident that I should have fruit, and of the

best kind, I now locked up my garden, and kept the key in my pocket. My visits were indeed frequent, and my watchfulness extreme, but abundance of the most tempting looking grapes I had ever seen, could not be neglected. To be brief, I kept them hanging a full month after every body pronounced them ripe, and from the richness of flavor, the delicious ripeness of full maturity, I was more amply rewarded than I had ever been before.

The fourth year, I pruned again, leaving three or four eyes on such fruit stems as I thought necessary, expecting (as I had before expected) to have a single bunch to every eye; that is, three or four bunches on each fruit stem. Guess my surprise, Mr. Editor, on now observing as the fruit came out, that instead of a bunch of grapes at each eye, a new fruit stem put out there, on which there were sometimes three, sometimes four, and I verily believe, sometimes five bunches. I was puzzled by this unlooked for quantity, which was four for one, and hesitated for some time what I should do. At length, however, the commendable desire of ascertaining a fact conquered my fondness for even such grapes as I enjoyed last year, and I decided to try *to save from the rot*, all; even the immense quantity of fruit that was daily advancing.

With this sole object kept in view, I pursued steadily my last year's plan. I nipped off daily, such young shoots as appeared, almost while in the bud, and especially kept the fruit stems, on which the grapes were hanging, from extending in length. Here and there I allowed a main shoot to push onward, as I contemplated erecting my twelve feet arbor, and looked forward to covering it in the most perfect manner—all other wood was kept down.

But I must conclude. My experiment of saving the grapes from dropping, succeeded beyond my most sanguine expectations; the fruit hung until a frost, but never ripened! There was more that could be perfected by much older vines.—Yet although I lost the use and enjoyment of it in its ripeness, I satisfied myself as to what it was that occasioned the rot in grapes. I am persuaded, it is because the growth of the vine itself is allowed to go on, after the fruit is set. Keep the young growth from putting out beyond an inch, by pinching it off short, and your fruit will not drop. When it is apparently ripe, let it still hang two or three weeks on the vine, (locking up your garden,) until perfectly matured; and in order fully to enjoy it, eat it early in the morning, or at mid-day.

My errors ought to be clearly stated; they were, first, in training up a single stem without a branch; from which mode, such of the vines as accidentally lost their leading shoot, were left, as the French say, "sans ressource," and died down to the ground, while others perished altogether.

The second was in neglecting to have substantial supports prepared before hand. From want of this my vines suffered, while the trouble it cost me was enormous.

My last error had nearly proved fatal. From permitting the vines to be completely exhausted by the quantity of fruit left on them—they will not recover their stength for years to come.

AN UPPER COUNTRY RECLUSE.

From Loudon's Gardener's Magazine for June, 1837.

ON THE CULTIVATION OF CURRANTS.

By T. Symons.

Currents being a very useful fruit for the table, as well as for tarts, preserving, &c., a hint may not be amiss to such as fail in cultivating them to that perfection which they are capable of being brought to by summer pruning. My method is this:—At the time they are about to set the fruit, I cut back, or pinch off, all such shoots as are not likely to be wanted for next year's wood, to about two inches from the spurs whereon the bunches of fruit are formed, taking care not to pinch them off too close, in which case the young fruit would wither. By this simple means, the fruit, by receiving more light and air, as well as a greater portion of assistance from the tree, will swell to to the greatest perfection. Should other superfluous branches shoot forth when the fruit is in a more advanced state, they are removed in a similar way, remembering, throughout the season, to keep the bushes as clear as possible of unnecessary wood. The result of this mode of treatment gained me the first prize last year at the Cornwall Horticultural Show at Truro. I should imagine this mode of treatment will answer well for gooseberries; and I should like to know if the Lancashire growers pursue, in any way, a similar method to the above.

The remarks in Vol. X. p. 41., first induced me to try the effect of summer pruning upon the currant; and I shall certainly now generally adopt it. I trust that others will follow the example.

Clowance, April 3, 1837.

From the same.

A MODE OF PRESERVING CAULIFLOWERS THROUGH THE WINTER.

By Peter Mackenzie, Gardener, West Plean.

Cauliflowers are a great favorite with all ranks of society; and I believe that, ever since they have been cultivated, means have been used to preserve them through the winter. I, like the rest of my brethren, have tried various methods to effect this; such as burying them in the earth, hanging them up by the roots, keeping them in frames, &c. But by none of these methods have I succeeded so well, as by the one I will presently state, which I have not seen nor heard of being practised by any one else.

Towards the end of autumn, I make a bed or beds, according to circumstances, of moist sand, in any cool house that will exclude the frost.—The beds should be four inches deep. Having previously planted a greater number of cauliflower plants than would be required at the time they are to come into use, I take the surplus, when in a good condition, and cut off their roots, leaving a stalk about three inches or four inches long; I then cut off all the leaves, except the innermost row; and, after shortening these, I insert the stalk into the sand-bed, and cover the cauliflower with a flower-pot. In this manner a large quantity may be contained in a small space: for example, a bed twelve feet square will hold 288 heads, allowing six square inches to each head. Again, by taking

those plants that are not in flower when the frost sets in, and preserving them, in a growing state, in any house or shed where light is admitted, and which will preserve them from a severe frost, these will come into use about the month of January; and, by cutting them, and putting them in the sand-bed, they will continue fit for use till the spring. In this way I have kept cauliflowers to the end of April. It will be necessary, from time to time, to examine and cut off any decayed part that may appear.

West Plean, January 7, 1837.

From the same.

ON KIDNEY-BEANS.

By A. Forsyth.

To force kidney-beans.—Plant any of the dwarf sorts (the dun-colored is generally preferred) in equal parts of rotten dung, reduced to a soil, and loam, in shallow twenty-four sized pots: say one inch crocks, one inch soil; then six beans, covering them with one inch more of soil. These pots may be stowed away in any corner of the stove, till the plants appear above ground, when they must be brought near the glass and thinned out to three or four of the best plants. As they advance, they must be earthed up; and the leader may be pinched off, to render them short and bushy.—When they come into flower, air must be admitted, to set the fruits; and every one must be gathered as soon as it is fit for the table, not to rob the others that are forming. The plants may be grown in a house at any temperature above freezing, and below blood-heat; the medium, 60° to 65°, I should prefer. They succeed well when planted out in a pit or frame, with or without bottom heat, in rows eighteen inches apart, and three, inches in the row; and, as they advance, they are to be topped as above, and sticked. Planted at Christmas, they require about eight weeks to bring fruit fit for the table, in a temperature as preferred above. *In the open border*, any of the sorts will answer well. Rich light soil, well drained and sheltered, is best. They may be planted in rows two feet apart, two inches asunder in the row, and two inches deep. It is seldom safe to have this plant, in leaf, unprotected, before the first of June, as the least frost would ruin all.—They can be forwarded in any warm nook, planted in pots, or on strips of turf, in a cold frame or matted bed; from which they can be easily removed, uninjured, to their final place of destination. They must be stopped, sticked, and picked, as directed above for those in-doors.

Isleworth, January 6, 1837.

From *L' Echo du Monde Savant*, April 12, 1837.

THE INFLUENCE OF VAPOR ON VEGETATION.

Messrs. Edwards and Colin have read, at the Academy of Sciences, a third memoir on the influence of vapor on all the periods of vegetation. They observed, first, that the grains of winter wheat did not germinate in air, because they were not saturated with moisture; but that the germination, which, when the grains are saturated with moisture, takes place in about eight days, happens in from sixteen to twenty-four hours, if the grains are plunged partly in water. From much experience, they have discovered that a temperature nearly constant (for example, that of a cellar of 50° Fahr.) is better for germination than a more elevated, but variable, temperature; since the variations of temperature prevent the air from being constantly saturated with moisture. It is worthy of remark, that the grains absorb more water in the latter case than when exposed to the uniform temperature of a cellar.

There are two conditions necessary for germination to take place in air: first, a certain proportion of water in the grains; and, secondly, that the air surrounding them be in an extremely moist state.

In air thus charged with moisture the grain commences by absorbing water; and, when, it has absorbed a sufficient quantity, if the temperature is constant, the air, still saturated with vapor, keeps the external membrane in a state of humidity, favorable to vegetation. If the humidity of the air varies, then the external membrane is not humid enough to perform its functions.

Messrs. Edwards and Colin have studied, according to these principles, the effect of the different kinds of humid soil on germination; and, finally, they have determined the effects of air saturated with vapor on vegetation, and have arrived at the result, that this is the condition of the air the most favorable for almost all plants.

In confirmation of this view, they have cited the observations made at Havanna by M. De la Sagra, and the practice in the stoves in England; where, by saturating the air with vapor, pine-apples are obtained of the weight of 8 lbs.

From the *Philosophical Journal*, vol. xxii. p. 383., 1837.

CONNEXION BETWEEN METEOROLOGY AND VEGETATION.

"M. Boussingault has addressed a note to the Académie des Sciences of Paris, which is entitled 'Comparative Examination of the Meteorological circumstances under which our common grains (the Cereàlia), turkey wheat (maize) and potatoes, vegetate at the equator, and in the temperate zone.' In this examination, the author has first made investigations into the time which elapses between the first springing of the plant and its full maturity. He then determined the temperature of the space of time which separates these two extreme epochs of vegetable life. By comparing these data concerning any given plant which is cultivated both in Europe and America, he arrives at this curious result: that the number of days that separate the commencement of vegetation from its maturity is more considerable in proportion as the mean temperature under the influence of which the plant grows is less; the duration of the vegetation will be equal, however different the climate may be, if this temperature is identical in the two places; and it will be shorter or longer, according as the mean heat of the period of time necessary for the accomplishment of the vegetation is itself greater or less; in other words, the duration of the vegetation appears to be in the inverse ratio of the mean temperatures. So that, if you multiply the number of days during which any given plant vegetates in these distant

climates by the mean temperature of the actual period of its vegetation, you will obtain numbers, which are very nearly equal. This result is not only remarkable, insomuch as it seems to indicate that, under all climates, the same annual plant receives, in the course of its existence, an equal quantity of heat; but it leads also to a direct practical result, in enabling us to decide upon the possibility of introducing any particular vegetable into a country, as soon as we know the mean temperature of the months there."

From Loudon's Gardener's Magazine for June, 1837.

KYANIZING WOOD FOR GARDEN PURPOSES.

By the Conductor.

In vol. xi. p. 536, a short notice is given of the nature of Mr. Kyan's process for the preservation, not only of every kind of wood, but also of every kind of vegetable fibre, whether in the form of cloth or cordage. The object of Mr. Kyan's composition is, to effect for wood what tanning effects for leather; and the chemical rationale of both processes will be found given in the *Architectural Magazine*, vol. ii. p 236. During the last twelvemonths, we have heard various accounts of the success of Mr. Kyan's invention; and the general effect upon our minds, till lately, has been rather unfavorable towards its use, than otherwise. Mr. D. Beaton, however, informs us that, while at Haffield, (which place he has just left, see p. 205.) he had an opportunity of using it, and seeing it used; and that he has formed a very favorable opinion, at least as to the use which might be made of it in gardening. He has had several deal boards saturated with it, and tallies for naming plants cut out of them; and he has seen thin elm boards, which, after being newly sawn up, had been saturated with the composition, remain in the sun, against a wall with a southern exposure, a whole summer, without shrinking or twisting in the slightest degree. He recommends all boards intended for hot-bed frames, plant-boxes, and all similar purposes, to be Kyanized; and we would farther suggest, that the process should be extended to all kinds of rods and stakes used for tying up plants, or for protecting single trees (such as those recommended by Mr. Lawrence, p. 166.); to all rods, twigs and boards used in summer-houses, rustic vases, ornamental fences, and espalier rails; and to all basket-work, hampers, wicker protectors for plants, &c. We would recommend all bass mats to be immersed in Kyan's composition; all netting and canvass made of hemp or flax; and all garden lines, sash-lines, packthread for tying plants, lists for nailing wall-trees, &c.— It is only necessary to send the articles which are to be Kyanized to the nearest Kyan's tank, where the process will be effected in forty or fifty hours, at a mere trifle of expense. These tanks are now established in various towns; and several gentlemen have private tanks for their own use. If the benefits to be derived from this composition come at all near to what is held out by the patentee, by Dr. Birkbeck, and Dr. Dickson, in his late lectures on the Botany of Architecture before the Institute of British Architects, wood tanneries will soon be as common as tanneries for leather.— There is a tank at Blackwall, where any gardener, within ten miles of London, may (with his master's permission) try some wood, cut into the form of tallies for pots, and also for plants in the open air, and other specimens of the articles mentioned above; and we should like much if they would do so, and, in a year or two, let us know the result. We intend ourselves to have some experiments tried; an account of all of which, with a particular account of the process, we shall give in the *Arboretum Britannicum*. In the mean time, we should be glad to hear the experience of different persons on the subject, from different parts of the country.

From Loudon's Gardener's Magazine.

THE PALO DE VACA, OR COW TREE.

After a variety of efforts, made through a considerable number of years, I have at last succeeded in obtaining, through the kindness of Sir Robert Ker Porter, the fruit of that interesting and valuable production of the coast of Venezuela, which has acquired such celebrity from the travels of Humboldt, and which furnishes such an abundant supply of vegetable milk to the thirsty peasants of those burning regions; I mean the *palo de vaca*, or cow tree, of which, I am inclined to suspect, there are, if not many different genera, at least some diversity of species. I am led to this conclusion from the discrepancy between the account given of the tree, the fruit of which has been now sent to me, and that of the illustrious traveller just mentioned; as, also, from the accounts formerly received from my valuable correspondent, of the three milk trees, the popa, the lerio, and laulè growing in the forests of the Chorò, along the banks of the river, near Citarà, or Quibbo, the capital.

I shall first transcribe the passage relating to the sort now sent, and some other matters, from Sir R. Ker Porter's letter of the 22d of last March, from Caraccas:

"I will not forget you on the subject of the *Lirio hermoso* (Pancràtium undulàtum *Humb.*) and will write to a friend in the Tay to get some lirio bulbs. I send you, with this, three seeds, or fruit, of the *palo de vaca*, or milk tree: one of them is in its husk, and the others are without it. I hope they will vegetate with you. The average temperature where these splended, lofty, and umbrageous trees grow, is from 70° to 76° of Fahrenheit, amidst a thick forest of other large trees, at an elevation of 3000 ft. above the level of the sea, in a soil black and rich, and containing a great degree of moisture the whole year through."

As the work in which Humboldt speaks of this remarkable production of a bounteous Providence may not be accessible to all your numerous readers, I shall, for their information, extract from the fourth volume of the English translation of his *Personal Narrative*, p. 212, 213, &c., the observations of this distinguished traveller, which differ in some slight degree from Sir Robert's account, and, at the same time, furnish particulars which he did not feel it necessary to introduce:

"We returned from Puerto Cabello to the valleys of Aragua, and again stopped at the plantation of Barbula, by which the new road to Valencia is traced. We had heard, several weeks before of a tree, the juice of which is a nourishing milk. It is called the cow tree; and we were assured that the negroes of the farm, who drink plentifully of

this vegetable milk, consider it as a wholesome aliment. All the milky juices of plants being acrid, bitter, and more or less poisonous, this assertion appeared to us more or less extraordinary; but we found, by experience, during our stay at Barbula, that the virtues of the *palo de vaca* had not been exaggerated. This fine tree rises like the broad-leaved star apple. Its oblong and pointed leaves, tough and alternate, are marked by lateral ribs, prominent at the lower surface, and parallel. They are some of them 10 inches long. We did not see the flower: the fruit (from the specimen sent to me, about the size and shape of a nectarine) is somewhat fleshy, and contains one, and sometimes two, nuts. When incisions are made in the trunk of the cow tree, it yields abundance of a glutinous milk, tolerably thick, destitute of all acrimony, and of an agreeable and balmy smell. It was offered to us in the shell of the *tuttono*, or calabash tree. We drank considerable quantities of it in the evening before we went to bed, and very early in the morning, without feeling the least injurious effect. The viscosity of this milk alone renders it a little disagreeable. The negroes, and the free people, who work in the plantations, drink it, dipping into it their bread of maize or cassava. The major domo of the farm told us that the negroes grow sensibly fatter during the season when the *palo de vaca* furnishes them with most milk. This juice, when exposed to the air, presents at its surface, perhaps in consequence of the absorption of atmospheric oxygen, membranes of a strongly animalised substance, yellowish, stringy, and resembling a cheesy substance. These membranes, separated from the rest of the more aqueous liquid, are elastic almost like caoutchouc; but they undergo, in time, the same phenomena of putrefaction as gelatine. The people call the coagulum that separates by the contact of the air, cheese. This coagulum grows sour in the space of five or six days, as I observed in the small portions which I carried to Nueva Valencia. The milk, contained in a stopped phial, had deposited a little coagulum; and, far from becoming fœtid, it exhaled constantly a balsamic odor. The fresh juice, mixed with cold water, was scarcely coagulated at all; but, on the contact of nitric acid, the separation of the viscous membranes took place.

"The extraordinary tree of which we have been speaking appears to be peculiar to the Cordillera of the coast, particularly from Barbula to the Lake of Maracaybo. Some stocks of it exist near the village of San Mateo (where the Victoria wheat is cultivated;) and, according to M. Bredemeyer, whose travels have so much enriched the fine hothouses of Schönbrunn and Vienna, in the valley of Caucagua, three days' journey east of Caraccas. This naturalist found, like us, that the vegetable milk of the *palo de vaca* had an agreeable taste and an aromatic smell. At Caucagua, the natives call the tree that furnishes this nourishing juice, the milk tree (*Arbol de Leche.*) They profess to recognise, from the thickness and color of the foliage, the trunks that yield the most juice, as the herdsman distinguishes, from external signs, a good milch cow. No botanist has hitherto known the existence of this plant, of which it is easy to procure the parts of fructification. It appears, according to M. Kunth, to belong to the *Sapòta* family. Long after my return to Europe, I found, in the description of the West Indies by Laet, a Dutchman, a passage that seems to have some relation to the cow tree. "There exist trees," says Laet (*Desc. Ind. Occ.*, lib. 18. c. 4. ed. 1633, p. 672.,) "in the province of Cumana, the sap of which resembles curdled milk, and affords a salubrious nourishment."

It is not here the solemn shades of forests, the majestic course of rivers, the mountains wrapped in eternal frost, that excite our emotion. A few drops of vegetable juice recall to our minds all the power, fulness, and the fecundity of nature. On the barren flank of a rock grows a tree with coriaceous and dry leaves. Its large woody roots can scarcely penetrate into the stone. For several months of the year not a single shower moistens its foliage. Its branches appear dead and dried; but, when the trunk is pierced, there flows from it a sweet and nourishing milk. It is at the rising of the sun that this vegetable fountain is most abundant. The blacks and natives are then seen hastening from all quarters, furnished with large bowls to receive the milk, which grows yellow, and thickens at its surface. Some empty their bowls under the tree itself; others carry the juice home to their children. We seem to see the family of a shepherd who distributes the milk of his flock."

Humboldt speaks of the cow tree as growing on the barren flank of a rock, where it has little soil, and less moisture. Sir Robert, on the contrary, says that it grows to a vast size in the depths of humid forests, where it enjoys a rich and fertile soil. The nature of the locality will account for the difference in the statements. In Kunth's description I have introduced those points in which he seems to differ from my specimen: the point of attachment of the footstalk (which is broken off) is deeply sunk in the body of the first, giving it almost the appearance of being hearted; the equatorial diameter (if I may use the expression) exceeds the polar, or that measured in the direction of the insertion of the footstalk; the former measuring 2 inches, the latter $1\frac{7}{8}$ inches only: hence its shape is more that of an oblate spheroid, or, rather, approaches to reniform.—The form of the specimen sent, on the contrary, approaches nearer to a sphere, being nearly $\frac{7}{8}$ of an inch in its polar, and somewhat less than in its equatorial, diameter; it has, also, a cicatrix at its base, as though it had been attached to a dissepiment.

In order to give a connected view of all the information I possess on the subject of this interesting tree, I shall now extract the particulars furnished to me by Mr. Thomas Higson, in a letter, dated Carthagena, May 16, 1824, eleven years ago.

Mr. Higson states, that this tree abounds in the deep and humid forests of the provinces of Choco and Popayan, on both sides of the line; but states that he had not been fortunate enough to see the flowers. He then gives some extracts from his Journals of the date of May 7, 1822, from which it appears that, during the intermission of an attack of intermittent fever, he accompanied the Alcaide and two other gentlemen from the town of Quibdo, on an excursion about twelve miles up the river, to examine the cow tree, which is there known by the name of *Popa;* the milky juice of which is procured by the Indians from incisions made in the trunk, and by the jaguars, or wild tigers, by lacerating the bark with their claws; and

he confirms Humboldt's accounts of its nutritive qualities, by remarking on the improved condition of both men and brutes during the season in which this milk is had in greatest abundance; although, he observes, "the better conditioned inhabitants, timid of its effects, and having other food, make no other use of it than to besmear straws to catch parrots, by placing them across their nests; and, by boiling it with the gum of the mangle tree (?), tempered with wood ashes, producing a glue impervious to moisture."

He then proceeds to state, that they obtained abundance of the milk, which he describes as being aromatic, sweet, of the thickness of good cream, and so white as to stain substances on which it fell pretty durably. He says, that it mixed as readily with spirits as cow's milk, and, either with it or with water, formed an agreeable beverage, of which they drank freely without injury. They cut down one of the trees, which he describes as being the loftiest of the forest, in order to obtain specimens, and found that the timber was white, with a fine grain, proper for boards or shingles. The flowers, which he was informed were very showy, were gone; but the branches were loaded with fruit, of about a month old, growing in clusters from the alæ of the leaves: they were scabrous, and about the size of small nutmegs. The leaves he describes as standing on short footstalks, coriaceous, hearted at the base, and marginate, or sometimes pointed at their summit: they were, he says, covered over, to a considerable extent, with large semi-globular glands. He considers this tree as different from Humboldt's *palo de vaca;* which latter he supposes to be the same with that called lyria in the Checo. In a further part of his letter, he speaks of some of the fruit of the popa gathered by himself in the wood of the Esca, adjoining Citara, or Quibdo, which he sent to our common friend Mr. Watts; and which, although he was uncertain how far they were sufficiently mature to germinate, were sufficient, he observed, to show that it was not a drupe, but a berry. It appears to me not improbable, although the observation seems to have escaped even the penetration of Humboldt, that the *Chichiuhalquehuitl* of the Mexicans, spoken of by Humboldt in the 2d vol. of his *Researches*, p. 32, on the authority of the *Codex Vaticanus* Anon., No. 3738, is a species of the *palo de vaca.* The MS. quoted contains, as he informs us, several curious figures; and, among the rest, one of the *Chichiuhalquehuitl*, tree of milk, or celestial tree, that distils milk from the extremity of its branches, and around which infants are seated who expired a few days after their birth.

Besides the popa and the lyria, Mr. Higson speaks of another tree, the milk of which is not so palatable, although yielded in far greater abundance. The milk of this tree, which is called sandè, is thinner than the former, of a bluish cast, like skimmed milk, not so pleasant to the taste, and not employed for food; but, in every other respect, closely resembling Humboldt's tree, rising, as Mr. Higson says, like a broad-leaved star apple (Chrysophyllum *Cainìto*), with alternate leaves seated on short petioles, 10 in. or 12 in. long, oblong, ovate, and sharp-pointed, with the veins alternate, and ferruginous underneath. The milk of this tree, inspissated in the lees, acquires the color and consistence of a black gum, prized as a medicine, especially for external use in splenitis and pleuritis. Such is the estimation in which it is held, that it sells, even in the vale of the Cauca, for a dollar the pound weight.

Thus, besides the *palo de vaca* of Humboldt, the locality of which appears to be limited to the Cordillera of the coast, we have here (if we can depend upon Mr. Higson's account) three other distinct milk trees, yielding a liquor more or less potable, and applicable to various other uses, belonging, possibly, to the same genus, or forming distinct genera of the same family, together with, perhaps, a fourth to be yet sought for amidst the unexplored parts of Mexico, and thus giving a far wider range to this valuable production than that assigned by Humboldt.

From the Southern Agriculturist.

ON THE INFLUENCE OF BURNT EARTH ON THE QUANTITY OF SPIRIT IN WINE.

Columbia, June 17, 1837.

Mr. Editor.—I saw accidentally, a French periodical, "Journal de Connoissancs Usuelles and Pratiques, &c." a very interesting publication. One article in it particularly attracted my attention, and I translate it into English, to be inserted in your Southern Agriculturist, if you think it worthy of it.

Yours, respectfully,
N. HERBEMONT.

By Mr. Jules Pagezy.

Chemical experiments have proven that the quantity of alcohol furnished by wine, is always in proportion to the quantity of mucilage and saccharine matter, (mucoso sueré) contained in the juice of the grapes. The soil, climate, and the kind of grape, exercise, in this respect on wine, a considerable influence, which is, however, modified by the exposition, the age of the vine, or the manures it receives. It has been asserted that animal manures, by increasing the products, impair the quality of the wine, and diminish the ordinary quantity of saccharine matter in the must. Mineral manures, such as ashes, lime, &c., are too little used in our part of the country, (the south of France,) because their influence on the production of alcohol has not been proved. Here are two observations which might prove that their use may offer advantageous results in argilaceous soils, which constitute a great part of the wine district in the south of France.

In 1831, I cleared, pared and burnt the edges of a vineyard, planted in the kind called "Piquepoule," of the age of from 10 to 12 years. The burnt earth was put during the winter, at the feet of the vines. The crop of wine in 1832, yielded 306 lbs. of alcohol per muid, of 90 veltes, about 680 litres *(a)* Mr. Claparède, the elder, a distiller at Montpellier, bought it of me, taking this yield of spirits for the basis of the price, which was ten francs per muid more than the usual price of commerce. I was astonished at the great quantity of spirits which this wine contained, and I explained this fact by attributing it to the exposition of the vineyard, which is most favorable; but I had this year, to seek other causes of a result, more extraordinary than that which I have just stated.

In the vicinity of the vineyard I have spoken of, there was uncultivated land, that I cleared,

pared and burnt. After having raised on it a crop of wheat, I planted this piece in a kind of vine called "Aremon." The vines were rooted plants. These vines grew most vigorously; and this year, 8 sétérées, (about 1 hectare, 60 ares) being 4 years old, and 20 sétérées (about 4 hectares) being 3 years old, produced about 36 muids of wine, without including about 4 muids of rotten grapes, which had to be abandoned. The vines, 4 years old, produced more than 2 muids per sétérée of 20 ares, and those three years old about one muid per sétérée. *(b)* The vintage took place from the 21st to the 23d of September. Every body knows how the last year was unfavorable to the perfect maturity of the grapes. Therefore, seeing the considerable quantity of fruit produced by these young vines, I was convinced that the wine produced by it would be very weak. I cannot express what was my surprize, when I had obtained the full conviction, that notwithstanding this cause, and that no less powerful one of the atmospherical circumstances, the quantity of alcohol contained in the wine, was, on the contrary, very great. In fact it yielded per muid—the wine which had been one night only in the vat after the grapes had been crushed—262 lbs. (French, about 294 lbs. English.) Wine fermented in the vat, (the length of time not specified) 256 lbs. and that from the press, 235 lbs.

Mr. Chassefière, a distiller at Montpellier bought this wine of me, which he distilled. Being still under the persuasion, that I could attribute this result only to the exposition of the vineyard, I submitted to the experiment some of the "Pique-poule," the crop of which had been gathered in the beginning of October, the produce of the vineyard, I have already noticed, and from six sétérées of plants 4 years old, placed in a soil which had not had the benefit of the paring and burning. This wine only yielded 240 lbs of alcohol. The exposition was the same, the maturity of the grapes more perfect for the "Pique-poule," than for the "Aremon," which had been gathered earlier on account of the rot which had already affected a great portion of the grapes. The ages of the vines were the same, and yet the difference was 22 lbs. of spirits per muid in the wine made in the same manner. I then recollected the wine of the "Pique-poule," sold to Mr. Claparéde in 1832. On referring to my books, I found that the year which had preceded this vintage, the vineyard had been manured with the burnt earth. I then found that the same cause had produced the same effect.

Experiments often repeated can alone give certainty to the facts that I advance, but they have appeared to me sufficiently important to claim the attention of our cultivators. Burnt earth gives the vines an uncommon vigor. Should not their use become more general, if we can acquire the certainty that, with the quantity of wine, the quantity of alcohol is also increased? I engage the proprietors of the vineyards to make experiments to obtain the solution of this important question, and I promise to continue mine, and to impart the result, whatever it be, to the society. My most anxious desire being that of contributing to the discovery of the truth.—*(Soc. Agr. Hérault.)*

Notes by the Translator.

(a.) 306 lbs. French weight is about 344 lbs. English. The muid about 180 gallons, the velte about two gallons, and the litre about one quart. This, then, gives 344 lbs. of alcohol to 180 gallons of wine. This is only an approximation of the reduction of measures of France to the English. I have not books at hand to enable me to get nearer.

(b.) The author of this article has somewhat mingled the new decimal weight and measures adopted in France, during the Revolution, with the measures of particular districts of the country. I cannot ascertain the meaning of sétérée, nor the exact contents of the muid he alludes to, as it is not the same all over France. This prevents our knowing the precise produce of the vineyards. The principal object, however, is obtained, of showing the advantageous effects of the burnt earth on the production of the vine. We have the less reason to doubt this effect, that it is well known that volcanic soils are celebrated for the strength and richness of the wines which they produce; and the adding of burnt earth to the natural soil, brings it in some small degree, to the condition of volcanic soils. This kind of amelioration, has also the great advantage over ordinary manures, that it introduces neither weeds nor grass in the fields improved by it. This article was thought the more interesting, that although given only for the benefit of the vine cultivator, it may also be as highly beneficial to almost all other kind of cultures. There is very little doubt that in many situations it would be highly beneficial to the cotton culture. The naming, particularly the cultivation of cotton here, offers me an opportunity to recommend to the perusal of cotton planters, a very excellent article on the subject of the rot in cotton, by Dr. Robert R. Harden.* It is one of the most judicious selections in the Southern Agriculturist for the present month, page 305. Very little doubt can be entertained that Dr. Harden has discovered the true cause of the rot in cotton, and the remedy is most obvious. The agricultors of the southern states are much indebted to the indefatigable and judicious exertions of this gentleman, not only for this, but for many other valuable communications, which have been noticed from his pen, for many years past.

From the Quarterly Journal of Agriculture for June, 1837.

EXPERIMENT IN FEEDING CATTLE ON DIFFERENT DESCRIPTIONS OF FOOD.

By Mr. Robt. Stephenson, Whitelaw, Haddington.

The cattle selected for this experiment were oxen rising two years old, and bred on the same farm. Their live-weights were ascertained at the beginning, during different periods, and at the end of the experiment. They were divided into three lots of six beasts each, and placed in open courts with sufficient sheds and stalls, and small mangers fitted up for corn and linseed cake. A correct account was kept of the weight of food consumed by each lot. Lot 1st were allowed linseed cake, bruised beans, and bruised oats, in addition to what turnips they could consume: and, for the last twenty-four days of the experiment, 20 lb. of po-

* Re-published in the Farmers' Register, p. 22, vol. v.—Ed.

tatoes per day were given to each beast. Lot 2d received the same allowance with the exception of linseed-cake; and, for the last twenty-four days they got only 10 lb. of potatoes, each beast, per day. And the 3d lot were fed on turnips alone. None of the lots were allowed hay. The objects of this experiment are, first: to compare cattle fed partly on linseed cake with those which had none; secondly, to compare those fed partly on corn with those which had none; and, thirdly, to compare those fed solely on turnips with those which had different sorts of food. From former trials we are inclined to believe that cattle consume food in proportion to their weights when nearly alike in condition. We therefore resolved, in this experiment, to divide the eighteen cattle, so as to confirm or refute this belief. They had been all kept in the same manner since they were calved, and were pretty much alike in condition, although varying considerably in weight. The six heaviest cattle, weighing in live-weight 486 imperial stones, were selected for lot first; the next six heaviest of 443 stones, constituted lot second; and the six lightest, made lot third, were 346¼ stones. These weights were ascertained on the 23d November, 1834, when the experiments began after the cattle had been in the court-yard from 20th September, 1834, and all fed on the same kind of food, namely, common white globe turnips. The white turnips given during the experiment were of good quality, raised with dung upon a rather stiff soil, and estimated about 20 tons per acre, their gravity on the 19th November, 1834, being 897.4 oz. per cubic foot. The Swedish turnips were also of good quality, grown on good clayey loam, 20 tons per acre by weight and measurement, their gravity being 1030 oz. per cubic foot on 19th November; but they had lost weight for bulk considerably by the 17th March following, when the last were raised from the ground, being then only 976.9 oz. per cubic foot. The white turnips used before the experiment commenced on 23d November, 1834, were raised with bone manure, and rather inferior in quality, being only on 19th November, 774 oz. per cubic foot. With these preliminary observations, we will proceed to state the particulars of the experiment.

1. Food consumed by each beast of lot 1st—

13 cwt. 1 qr. 16 lb. white turnips from 22d November, to 3d December, 1834, ten days, being 150 lb. per day at 3d. per cwt.	£0	3	4
30 lb. bruised beans, for 10 days, being 3 lb. per day at 13s. per boll, allowing 60 lb. to the bushel,	0	1	7½
40 lb. linseed-cake, for 10 days, being 4 lb. per day at ¾d. per lb. or £7 per ton,	0	2	6
25 cwt. 3 qr. 20 lb. Swedish turnips, from 3d December to 25th December, 1834, 22 days, being 132 lb. per day, at 4d per cwt.	0	8	7½
88 lb. linseed cake, for 22 days, 4 lb. per day, at ¾d per lb.	0	5	6
66 lb. bruised beans, for 22 days, being 3d per day,	0	3	7
69 cwt. 0 qrs. 21 lb. Swedish turnips, being 123 lb. per day for 63 days,			
Carry forward,	£1	5	2
Brought forward,	£1	5	2
from 25th December, 1834, to 26th February, 1835,	1	3	0¾
189 lb. bruised beans, for 63 days, being 3 lb. per day,	0	10	2½
126 lb. bruised oats, for 63 days, being 2 lb. per day, at 20s. per qr., say 42 lb. per bushel,	0	7	6
189 lb. linseed cake, for 63 days, being 3 lb.* per day,	0	11	9¾
21 cwt. 2 qrs. 2 lb. Swedish turnips, being 100 lb. per day, from 26th February to 22d March, 24 days,	0	7	2
480 lb. potatoes, for 24 days, being 20 lb. per day, at 6s. per boll of 4 cwt.	0	6	5
72 lb. bruised beans, for 24 days, being 3 lb. per day,	0	3	10¾
48 lb. oats, for 24 days, being 2 lb. per day,	0	2	10½
72 lb. linseed cake, for 24 days, being 3 lb. per day,	0	4	6
Total cost of feeding one beast of lot 1st	£5	2	7

2. Food consumed by each beast of lot 2d—

14 cwts. 1 qr. 24 lb. turnips, being 162 lb. per day, for 10 days, at 3d. per cwt.	0	3	7½
30 lb. bruised beans, for 10 days, being 3 lb. per day,	0	1	7½
29 cwt. 1 qr. 24 lb. Swedish turnips, being 150 lb. per day for 22 days, at 4d. per cwt.	0	9	9¾
66 lb. bruised beans, for 22 days, being 3 lb. per day,	0	3	7
67 cwt. 2 qrs. Swedish turnips, being 120 lb. per day for 63 days,	1	2	6
189 lb. bruised beans, for 63 days, being 3 lb. per day,	0	10	2½
126 lb. oats, for 63 days, being 2 lb. per day,	0	7	6
24 cwt. 2 qrs. 16 lb. Swedish turnips, being 115 lb. per day, for 24 days,	0	8	2½
240 lb. potatoes, for 24 days, being 10 lb. per day,	0	3	2½
72 lb. bruised beans, for 24 days, being 3 lb. per day,	0	3	10¾
48 lb. oats, for 24 days, being 2 lb. per day,	0	2	10½
Total cost of feeding one beast of lot 2d.	£3	17	0

3. Food consumed by each beast of lot 3d—

11 cwt. 3 qrs. 14 lb. white turnips, being 113 lb. per day for 10 days, at 3d. per cwt.	£0	2	11½
22 cwt. 2 qrs. 10 lb. Swedish turnips, being 115 lb. per day for 22 days, at 4d. per cwt.	0	7	6¾
64 cwt. 2 qrs. 21 lb. Swedish turnips being 115 lb. per day for 63 days,	1	1	6¾
19 cwt. 2 qrs. 24 lb. Swedish turnips, being 92 lb. per day for 24 days,	0	6	6¾
Total cost of feeding one beast of lot 3d,	£1	18	7½

Abstract of Cost of Keep.

Lot 1st, 119 days, £5 2 7 = 6.0343 shillings per week.

*It will be observed that the linseed cake has been reduced from 4 lb. to 3 lb. per day, because the cattle, on being allowed oats in addition to the beans, would not eat more than 3 lb. of linseed cake per day.

Lot. 2d, 119 days, 3 17 0 = 4.5294 shillings per week.
Lot 3d, 119 days, 1 18 7¼ = 2.2712 shillings per week.

Improvements in Live Weight.

	Lot first.		Lot second.		Lot third.	
	Live weight in stones	Improvement, in stones.	Live weight in stones.	Improvement, in stones.	Live weight in stones.	Improvement, in stones.
Nov. 23, 1834,	485	-	443	-	346½	-
Dec. 25, "	520	34	469	26	354½	8
Jan. 24, 1835,	554	34	499½	30½	375	20½
Feb. 25, "	582	28	528	28½	389	14
Mar. 23, "	594	12	544	16	395½	6½
Total improvment in seventeen weeks.		108		101		49

We have thus obtained data on which we can ascertain whether the foregoing methods of feeding of cattle can be practised without loss.

We regret that we are unable to present the amount of the beef, tallow, and hides, of all the cattle in this experiment when killed, having only obtained a correct return of four of them, which were slaughtered by Mr. M. Hutchison, Leith. But as we have ascertained pretty accurately the dead weight of cattle, from a number of experiments on those of like condition and age, by multiplying the live weight by the decimal .571, we shall apply this rule to the live weights in the above table, in order to ascertain the quantity, and estimate the value, of the beef produced; and we shall add 6*d.* per stone to the beef, being its increased value by feeding at the end of the experiment. The tallow is about $\frac{8}{100}$ of the live weight, or that multiplied by .08 will give the nett weight of the tallow. The hide is about $\frac{5}{100}$ part of the live weight, or that multiplied by .05 will give the nett weight of the hide; and the live weight multiplied by .28, will give the weight of the entrails and refuse.

Lot 1st, subjected to these rules, stands thus:

Improvement in live weight, 108 stones equal 61 stones, 10 lb. beef, at 6*s.* per stone.	£18	10	3¼
Increased value of the carcass of 339 stones, at 6*d.* per stone.	8	9	6
Increase of value from feeding,	£26	19	9¼
Deduct cost of keep of each beast, £5:2:7 by 6,	30	15	6
Loss on feeding lot 1st,	£3	15	8¾

Being £12: 6: 0¾ per cent.

Lot 2d—Improvement of live weight, 101 stones, equal 57 stones, 10 lb. beef, at 6*s.* per stone,	£17	6	3½
Increased value of carcass of 310 stones, at 6*d.* per stone.	7	15	0
Increase of value from feeding,	£25	1	3
Deduct cost of keep of each beast, £3, 17*s.* by 6,	23	2	0
Profit on feeding lot 2d,	£1	19	3½

Being £8: 10: 1 per cent.

Lot 3d—Improvement of live weight, 49½ stones, equal 28 stones, 4 lb. beef at 6*s.* per stone.	£8	9	8½
Increased value of carcass of 326 stones at 6*d.* per stone,	5	13	0
Increase of value from feeding,	£14	2	8½
Deduct cost of keep of each beast, £1: 18: 7½ by 6,	11	11	7½
Profit on feeding of lot 3d,	£2	11	1

Being £22: 1: 1 per cent.

Thus, when turnips alone were used, a profit of 22 per cent. was realized; when corn was used along with turnips, the profit was diminished to 8½ per cent.; but when still more expensive food was used, that is, corn and linseed cake, along with turnips and potatoes, a loss was sustained of no less than $12\frac{3}{10}$ per cent.

Two pairs of the above cattle were selected and exhibited at the Local Show in this county, and gained the first prizes as the best beasts bred in the county. One pair belonged to lot 1st, and the other pair had one beast from lot 1st, and another from lot 2d. They were sold on the ground for £20 a-piece. Their live and dead weights were respectively as follows:—No. 1, live weight 112 stones; dead weight of beef, 66 stones, 2 lb; tallow, 8 stones 10 lb.; hide, 5 stones 11 lb.; other offals, 32 st. 5 lb. No. 2, (from lot 2d,) live weight 100 stones; dead weight of beef, 58 stones, 6 lb.; tallow, 7 stones 7 lb.; hide, 4 stones 12 lb.; other offals, 29 stones, 3 lb. No. 3, live weight 103 stones; dead weight of beef, 62 stones, 3 lb.; tallow, 9 stones; hide, 4 stones 12 lb.; other offals, 26 stones 13 lb. No. 4, live weight 109 stones; dead weight of beef 62 stones, 4 lb.; tallow, 9 stones, 4 lb.; hide, 5 stones, 12 lb.; other offals, 31 stones, 8 lb.

We shall give another view of the subject by estimating the cost of producing a lb. of live weight.

Lot 1st cost 4.884 pence for every lb. of increased live weight.
Lot 2d cost 3.92 pence for every lb. of increased live weight.
Lot 3d cost 4.39 pence for every lb. of increased live weight.

We are not aware that any one has hitherto attempted to assign the separate agency of each kind of food in the production of live weight, when more kinds than one are employed in the feeding of cattle. Could this be done in a satisfactory manner, the question would at once be set at rest—Which food was the most profitable? We have already stated the cost of producing 1 lb. of live weight in each of the three lots of cattle in this experiment, where it appears that the joint agency of turnips and corn is the cheapest of the three. But we are not prepared to say that the like result will be uniformly obtained, because, although observing the improvement in live weight of a considerable number of cattle on a given quantity of turnips to be, on an average, an increase of 1 lb. of live weight for every 90 lb. of turnips, under good management, and with good cattle, yet we have seen cattle which did not improve 1 lb. of live weight for every 1000 lb. of turnips. By this experiment, lot 3d only increased a lb. of live weight for every 116 lb. of turnips; and it will be observed, from what cause we know not, that for the first thirty-two days of this experiment, this

lot increased only 8 stones. Now, for forty-six days immediately preceding 23d November, 1834, the beginning of the experiment, these same six cattle increased 48½ stones, or 113 lb. each beast; while, from a trial made for eight days, from 7th till 14th November, inclusive, they consumed 160.85 lb. each per day of common turnips (white globe,) which gave only 65.47 lb. of turnips to a lb. of increased live weight. But, avoiding lengthened details of other experiments, we will assume 90 lb. of turnips, as being equal to the production of 1 lb. of increased live weight, and from this datum, endeavor to ascertain the agency of each different kind of food employed in the feeding of lots 1st and 2d. We shall begin with lot 2d, and divide 6 times 15,226, the quantity of turnips consumed by this lot, by 90, and the quotient is 1015 lb. of live weight, as having been produced from the agency of turnips. Lot 2d, also, consumed 1440 lb. potatoes. We say that 40 lb. of potatoes will yield 1 lb. of increased live weight, the result will therefore be 1440 divided by 40, equal 36 lb. of live weight as having been produced from the agency of potatoes; therefore 1015 add 36 equal 1051, and the remainder, 363 lb. as having been produced by the agency of corn, which make up 1414 lb. the total increase of live weight.

Lot 1st, by the same rule, stands thus:—

14,563 by 6, equal 87,378, divided by 90, equal 970 lb. of live weight, by the agency of turnips.

480 by 6, equal 2880, divided by 40, equal 72 lb. of live weight, by the agency of potatoes.

531 by 6, equal 3186, divided by 8.77, equal 363 lb. of live weight, by the agency of corn.

389 by 6, equal 2334, divided by 21.81, equal 107 lb. of live weight, by the agency of linseed cake.

The cost of producing a pound of increased live weight by the above data is—

90 lb. of turnips at 4d. per cwt., equal 3.2142 pence.

40 lb. of potatoes at 1s. 6d. per cwt., equal 6.4285 pence.

8.77 lb. of corn at 3s. 3d. per bushel of 60 lb., equal 5.7 pence.

21.81 lb. of linseed cake at ¾d. per lb., equal 16.3575 pence.

Although we have assumed, in the above calculations, that 40 lb. of potatoes are equal to 90 lb. of turnips in the production of live weight, we are far from believing that proportion correct in point of fact. On the contrary, we should say, that 90 lb. of turnips are fully equal to 70 lb. of potatoes, and that the latter is perhaps the most expensive food usually given to cattle; and certainly, so long as potatoes fetch 1s. 6d. per cwt. in the market, cattle on that food will soon, to use a familiar phrase, "eat off their own heads." When any other food than turnips is desired for feeding cattle, we would recommend bruised beans, as being the most efficient and least expensive; on this account, we would prefer bruised beans alone to distillery offal. As regards linseed cake, or even potatoes, they are not to be compared to beans. In confirmation of this opinion, we may be permitted to state shortly the improvement made by three cattle last season, 1835–6, of the same age and sort, indeed own brothers, to three of the cattle in lot 1st of our experiment. They were fed on white turnips until 27th January, and after that date on Swedish; and, as we meant then to compete for the prize given or the *best beasts* bred in the county, we allowed them from 10th December 3½ lb. of oats and beans, and 3½ lb. of hay each per day. And, in order that a comparison may be made with the lot 1st of our experiment, we will state the improvement in live weight as near the same period as the dates of weighing will admit. The live weight of the three cattle on the 25th November, was 273 stones, and on the 31st March 338 stones, being an increase of 65 stones, or 21⅔ stones each, in 127 days; while by our experiment, lot 1st, in 119 days gained only 18 stones each, being a difference of 3⅔ stones in favor of last season. A pair this season also gained the prize as the best beasts bred in the county, against others which had been fed on as much linseed cake as they could eat. Our pair of two years' old were sold, 16th May, 1836, for £55, 10s. We were at very great pains in the keeping of our two-year old cattle this season, having cut all the turnips for them, white as well as Swedish. We have always been in the habit of cutting the Swedish turnips, but never till this season did we cut the white also. In conclusion, on this part of our subject, we give it as our opinion, that whoever feeds cattle on *turnips alone* will have no reason, on the score of profit, to regret their not having employed more expensive auxiliaries to hasten the fattening process. This opinion has not been rashly adopted, but has been confirmed by a more extended and varied experience in the feeding of cattle than has fallen to the lot of most men.

That cattle consume food something nearly in proportion to their weights, we have very little doubt, provided they have previously been fed in the same manner, and are nearly alike in condition. Age, sex, and kind, have little influence in this respect, as the quantity of food consumed depends much on the length of time the beast has been fed, and on the degree of maturity at which the animal has arrived—hence the great difficulty of selecting cattle fit for experimenting upon. To explain our meaning by an example, we would say that two cattle of the same weight, and which had been previously kept for a considerable time on similar food, would consume about the same quantity. But, on the contrary, should two beasts of the same weights be taken, the one fat and the other lean, the lean beast would eat twice or perhaps thrice as many turnips as the fat one—more especially, if the fat one had been for some time previously fed on the same food, as cattle eat gradually less food until they arrive at maturity, when they become stationary in their appetite. We have had great experience in feeding stock, and have conducted numbers of experiments on that subject with all possible care, both in weighing the cattle alive, and the whole food administered to them, and in every experiment we made, we discovered something new. But we have seen enough to convince us that were the art of feeding better understood, a great deal more beef and mutton might be produced from the same quantity of food than is generally done.

We had on turnips, at the time we were conducting the foregoing experiments, 5 queys of the same age and sort as the 18 stots, also 20 three-year old stots, such as are bred on the Perthshire braes, in one court, and 14 Fife stots in another court. Five of an average size and weight, from each of the lots of Perthshire and Fife stots, were selected, and their live weights ascertained, and the turnips consumed by them weighed. They

were weighed on 25th December, and the quantities of turnips consumed were ascertained from an average of the weeks previous and subsequent to that day. The result was as follows:—For every stone they were of live weight, the cattle consumed of Swedish turnips each day, the Perthshire stots 1.861 lb.; the Fife ditto 1.781 lb.; the two-year old queys 1.8881 lb.; lot 3d of our experiment, fed on turnips alone, 1.948 lb.; lot 2d of our experiment, assuming the value of the food other than turnip, as stated in the previous part of this paper, 2.3; lot 1st of our experiment, under the same condition as lot 2d, 2.07. We must not be understood as presenting the above ratio of weight of beasts to weight of turnips as uniform. On the contrary, the ratio varies according to condition and food; we took the ratio at the end of December as a medium period. These same cattle, in the beginning of November previous, when on common white turnips, consumed them in the following ratio:—The Perthshire stots 2.7 lb.; the Fife stots 2.61. Lot 1st of our experiment, when on turnips alone, before the experiment, 2.28; lot 2d under the same conditions, 2.8; and lot 3d under the same conditions 2.772. No note was taken of the white turnips consumed by the queys. It is not uncommon for a lean beast to consume more than a fourth part of his own weight of food every day, while a very fat one will not consume one-tenth. We kept two of the cattle of lot 3d until the end of December, 1835, when their live weights were increased to nearly double, and they then only consumed 1.5 lb. of turnips for each stone of live weight.

We shall conclude by relating a singular fact, which is in some degree connected with this subject: sheep on turnips will consume nearly in proportion to cattle, weight for weight, that is, 10 sheep, 14 lb. per quarter, will eat nearly the same quantity of turnips as an ox of 40 stones; but turn the ox to grass, and six sheep will be found to consume an equal quantity. This great difference may perhaps be accounted for by the practice of sheep cropping the grass much closer and oftener than cattle, and which of course prevents its growing so rapidly with them as with cattle.

NOTE.—[Mr. Stephenson, of date 22d May, 1837, writes thus:—"In the last number of the Transactions, I observe from Mr. Boswell's Report, on Feeding Cattle, a remarkable coincidence of what is stated by me. Mr. Boswell has given the live weight of his cattle, and the quantity of food consumed by them, and from these you will find the following results. In the cattle at Kingcausie, 94.841 lb. of yellow turnip produced 1 lb. of increased live weight in the hemmels, and 126.204 lb. in the byres; and every stone of live weight consumed 1.411 lb. of turnips in hemmels, and 1.383 lb in byres. In the cattle at Balmuto, 96 lb. of turnips and potatoes produced 1 lb. of increased live weight in the hemmels, and 112.678 lb. in the byres. And every stone of live weight consumed 1.325 lb. of turnips in the hemmels, and 1.262 lb. in the byres. These results arise from taking the average weight of cattle at the middle date, and the average weight of turnips consumed each day."—ED.]

From the Silk Culturist.

ONE BUD.

In propagating the morus multicaulis from cuttings, most cultivators have hitherto considered two buds to each cutting indispensable to the production of a tree, on the supposition that one bud threw out the root, and another the shoot; but the prevalent opinion now is, that one bud is as good as two, and some think better. The notion that the root proceeds from a bud is now generally exploded, and most propagators use cuttings with one bud only, that being sufficient to send out a shoot, which is all that is necessary to the formation of a perfect tree. Our confidence in this theory is so strong that we have adopted it in our own practice, having put out most of our cuttings with a single bud. Other nurserymen in this region, so far as we are informed, are following the same course, and the question will be finally settled the coming autumn by the results of numerous experiments.

But, we are not without some experience on the subject. The trial has been made, and complete success has attended it. The following extract from a letter from a scientific and practical cultivator in Virginia, to his correspondent in this state is, to our mind, conclusive evidence, not only that two buds are not necessary, but that one is better than two in most cases. He says:—"I put about 400 cuttings in a hot bed, on the 15th of February, [1837.] They varied in size from a half an inch to three inches in length, and from one and a half inches to less than an eighth of an inch in diameter, and I believe every one is growing—*more than a dozen of them are already bearing fruit.* There are some with shoots not more than three inches high, with three mulberries to each, the size of our common white mulberry. Some of the cuttings, one and a half inches in diameter, and two inches long, are sending up two shoots. I was looking at others to-day not half an inch long and one eighth of an inch in diameter, with five vigorous shoots to each.

It is often asserted in books, and in the periodicals, that two buds or necessary to a cutting. My own experience, drawn from a close watching of these cuttings, in my hot bed, is that one bud is not only all that is necessary, but that one is better than two, and I have accordingly put out all my cuttings with one bud on each. They say that the lower bud is necessary for roots, and that it turns into roots. This is not so. I have taken up my cuttings in the hot bed repeatedly, and though I planted in the first instance with two buds, and have found that the lower bud, instead of turning into roots, was trying to turn into a stalk, while the roots were coming out just below the bud. So I cut them all into two, and they are now all doing well with a single bud. The roots come out just below the bud, and are sufficient to the support of the one shoot. If you have two buds, and but one in the ground, the upper cannot put out roots, and the shoots of the lower being insufficient for it and also for the shoot that is trying to form below, the plant withers and droops under the hot sun, and accordingly many persons shade their young trees from 10 o'clock A. M. to 2 o'clock P. M. Give each bud its roots, and this will not be necessary. Thus I have reasoned, and have put my cuttings at once into their place in the field, instead of a nursery with conveniences for shading as is usually recommended. I have thus doubled my number of cuttings, and shall save the immense labor of transplanting in the hot season. The roots spring also, by and by, from the end of the cuttings; but in the first instance only from the little whitish knobs, which you may see, just below the

bud. Put the bud about half an inch beneath the surface of the ground.

I have put out 35,000 cuttings of the multicaulis, and as I hope to get an abundance of leaves this summer, have also procured 23,000 eggs from Hartford, and as soon as we get through the corn-planting, shall put up a cocoonery. The business is making a good deal of noise here; and, if I succeed, there are dozens who will immediately follow suit."

ON SPRING WHEAT.

To the Editor of the Farmers' Register.

For some years past, the wheat crop has been so liable to failure, that it is natural our farmers should endeavor to devise some expedient to obviate it. With this view, several experiments have recently been made with *spring wheat;* and, as far as I have heard, the result has been quite encouraging. It is sincerely to be hoped that future trials may be equally successful; but, in the climates of Virginia and Maryland, I am unable to satisfy myself that it can be cultivated to permanent advantage. The present season has been one of peculiar character; the atmosphere has been dry and cool, and so eminently conducive to the gradual advancement and maturity of the crop, that the harvest has been more abundant by many fold, and the grain of better quality, than could have been anticipated by any person a few months ago. Had this season been like the last, or *vice versa*, the results of each would have been entirely different. Our springs are frequently hot and moist; and if, under such circumstances, the wheat be retarded beyond the usual period of ripening, either by being too thin, or by being sown too late, or by being of a late variety, that potent enemy, the *rust*, is sure to lay his hands upon it; and, in a few days, a whole field will sink under the attack. In New York and New England, the climate is very different. The harvest is prolonged to a much later period, than with us; and they have no scorching suns to dry up the sap prematurely; or, when combined with excessive moisture, to induce the rust. The spring wheat is, therefore, much more likely to succeed in a northern latitude than with us: indeed from the character of a northern winter, it is altogether probable that spring sowing may be the most profitable.

Another circumstance has combined with the favorableness of the season, to render the product of spring wheat more flattering. It is a well known fact that vegetables raised from northern seed, arrive at maturity in a much shorter time than it would require for the same varieties when introduced from the south.

My remarks are not intended wholly to discourage the growing of spring wheat, but merely to caution against sowing it too extensively another year; which many might be tempted to do in consequence of the success they have just had. If, after the experience of several years, it shall be found to be as productive as winter grain, it may then, very properly, in a measure, take the place of the latter; but until the advantages of spring culture shall be established, I would respectfully suggest to my brother farmers the propriety of not relying too much upon it.

A PRACTICAL FARMER.

From the Farmers' Magazine.

POINTS IN CHEMISTRY APPLIED TO AGRICULTURE.—SOILS.—No. 1.

Plants are mainly indebted for support to the decomposed remains of things at one time possessed of life, and with which the surface of the earth is found to be impregnated. The decay of vegetables and animals is thus contrived to minister to the sustenance of organization. Life is produced by dissolution. By one of the most beautiful, yet simple, of processes, the adult plant calls the germ into existence, and afterwards furnishes the supplies which are to bring it to maturity. Nothing is wasted—nothing is misapplied. The produce of one year goes to form the harvest of the next. The herb returns to the dust from which it was derived, only to rise in renewed beauty when the appointed season shall call it from its tomb. Hence the words of Pope—

"See dying vegetables life sustain,
See life dissolving vegetate again."

"Ever changeful, ever new," the plant is always in perfection. So soon as it has attained the limit assigned to it by nature, it ceases to cumber a soil that it can no longer adorn. It then becomes subject to the laws of chemistry; its elements separate and slowly form the combinations already mentioned, which, in no long time, become constituents of succeeding crops.

"——— All, to re-flourish, fades:
As in a wheel, all sinks, to re-ascend."

The value of a soil for the purposes of agriculture, may be judged of in one of three ways—by the quantity and quality, or the crop which it affords on being subjected, for a series of years, to cultivation; by the nature of the herbages, which is spontaneously yielded by the ground; or by the quantity of requisites for the support of vegetation, which it may be found, on chemical analysis, to afford. With the first method we have, for obvious reasons, nothing to do in an article like the present. The second is apparently a mode devoid of difficulty, and easily had recourse to on all occasions; and, as the question as to the extent of its utility is interesting, from the attention that has of late been turned to it, we shall, for the moment, confine ourselves to an examination of its excellencies and defects. Though it is a test that has been resorted to by agriculturists from the earliest ages, little of any consequence was known by the ancient tillers of the ground, regarding the connection between the prevailing material of a soil and its spontaneous produce, further than that, in the words of Virgil—

"All grounds not allthings bear;———"

and their observations were limited to the almost regular occurrence of plants of a larger growth, such as the alder, the ash, the myrtle, and the vine, on soils of particular texture and composition.

Of late years, considerable attention has been drawn to the subject in this country, owing to the premiums offered by the Highland Society for communications on the nature of soils, as indicated by plants; and, as was expected, much interesting information has been obtained. Several of these essays have been published by the Society. All are good, and form the vehicles of something valuable; but two are, in particular, worthy of consideration, as containing the result of much pa-

tient observation, and being tolerably free from defects, in the grouping and arrangement of the materials. The authors of these articles, are—Mr. Macgillivray, conservator in the Museum of the Royal College of Surgeons, in Edinburgh, and Mr. Archibald Gorrie, Annat Garden, Perthshire, both gentlemen admirably qualified, by the nature of their pursuits, to furnish remarks of no mean value to botanical science; while the former, from his extensive excursions in the northern counties, and in the western islands, is enabled to improve our ideas on the subject, by references to the soils of particular localities.

Soils, in general, only give rise to plants, for the rearing of which they appear, owing to the pos session of some ingredients, to be peculiarly adapted. The well-known fact, as to the ashes of burnt fir trees affording a congenial soil to the seeds of the wild rasp, and, being usually covered by such bushes, may be taken as a familiar illustration.—Not only is the nature of the plant occasionally determined by the composition of the soil, or, in other words, not only are individual soils restricted, owing to some peculiarity in their construction, to the growth of a limited number of genera, but the *parts* of the plant are also liable, from similar causes, to considerable variety. When tulips, for example, are planted in too rich a soil, the colors spread; or if they have steadily remained of one color in some particular soil, they will, on being removed to another, break into a variety of colors. A blue tinge may be given to the petals of hydrangeas, by placing them in the red earth which borders on chalybeate springs, and which for that reason is well impregnated with iron. The blossom of a common primrose, whose root has been taken up and planted in another soil, loses its yellow hue, and becomes of a pale-brown or chocolate color.

Many plants delight only in soils of a peculiar nature, luxuriating so long as they are adherent to ground of a particular constitution, but rapidly losing in vigor and appearance when deprived, by any means, of the food to which they appear to be naturally adapted. "The Scotch fir, *pinus sylvestris*, thrives well, but does not grow fast on the soil over the sandstone. Its wood, however, is tough, and very durable. But when this same tree is planted on the graywacke, though it grows more rapidly, and arrives sooner at maturity, yet, being softer, and fuller of white wood than that grown upon the sand-stone, the builder, to his cost, finds that it is soon attacked by the worm, and decays. The reverse of this happens with the larch, *pinus larix*, when growing on the graywacke. Its wood is sound and good, and, when cut down, is at heart quite perfect. But on the sandstone and gravels of this basin (Closeburn), it seems to be at maturity at an earlier age than that growing on the graywacke, and, in many instances, when cut down on the soils, the larch presents a tubed decayed heart."* Plants, however, are seldom in error as to the choice of a locality, for the simple reason that the soil, which will not yield to them the nutriment they require, either allows the sprout to perish before it meets the light, or, at best, affords so grudgingly the elements of life, that the sickly vegetable is fain to bow before the sun and wind, which, in more favorable circumstances, would have served to ripen and rock it to maturity. When trees are planted by man, they are, in numberless instances, placed in soils and situations which, if not inimical to the continuance of their lives, are at least adverse to their attaining health and common-place proportions. Man is in this way perpetually at war with physical circumstances, which a closer inspection of natural phenomena would show him that it is almost impossible to overcome. Doubtless he may, in many cases, undesignedly contend with powers whose workings cannot be opposed, because they are beyond the ken of his knowledge and experience, and his strivings may even be attended, in spite of such untoward operations, with a fair run of success; but surely, that is not to justify him in proceeding contrary to what is dictated by the more or less perfect adaptation exhibited in the conjunction of every stone and bush, and in neglecting to profit, as he would do, by making his designs the counterpart of those upheld to him by nature. We constantly see trees occupying ground, the features of which tell us at once that there they are completely out of place, and that human interference must have been at work to entice them so far from their usual habit and locality. Pines are indigenous to sandy regions, and only come to their native wire-drawn scragginess in the vicinity of sandstone; the oak, the elm, and the ash, delight in rich thick loam, and only acquire perfection when spreading their ample and stalwart arms over a deep and fertile mould; the pensile willow is redolent of health and beauty, only when reclining over the margin of the stream; and the birch and alder are indifferent, indeed, unless in connection with the bleak moist sides of the northern mountains, to which we might almost say they love to cling; yet we hourly find that their peculiarities, in the choice of soil and situation, are set at naught, and this even in places where their planter has had every facility for placing them in their respective and appropriate abodes. When the dispersion of seeds is left to fortuitous interference, to be transported through the medium of the air, of water, or of animals, how seldom have we cause to fault the bed which they discover (if we may so speak) for themselves? Rarely do we light upon a shrub or tree, sprung from a soil unsuited by temperature or composition, to bring it to perfection. This may, however, be accounted for by the fact, that the greater number of plants attach themselves indiscriminately to any of a wide range of soils, and thrive upon them with the same accommodating facility; but there are, on the other hand, several plants restrained by some unknown peculiarity to certain limits, beyond which ordinary causes fail to carry them. For example, to quote from the author to whom I am already indebted for an illustration—"The larch grows naturally only on the primitive mountains, as the granite, gneiss, and the like rocks of that class, of the Alps in Switzerland. And it is most curious to observe, that, on the whole range of the Jura mountains, separating that country from France, and, being a limestone formation, rising to an elevation of several thousand feet, *not a single self-sown larch can be discovered.* Advancing, however, from this range into Switzerland, it may be observed, that in those places, as at Chamouni, Mount Cenis, the Simplon, and the lofty Alps, which partly enclose the beautiful lake of Thun, in the Canton of

*J. S. Monteath, esq., in Edin. Phil. Journal, No. 9.

Berne, where the primitive formation, consisting of granite, gneiss, mica-slate, and similar rocks, abounds, the larch is indigenous, growing luxuriantly, and attaining to a great size."

Clay, sand, gravel, and peat, combined in various proportions, form a base or soil, in the interstices of which, materials, capable of affording nourishment to plants, are rendered fit to be turned to account in their economy. Plants, as well as animals, require for their support a due supply of the elements of which they are composed, and these they obtain from amongst the earthy particles in which their fibres are imbedded. The soil, in fact, is to a plant what the stomach and intestines are to animals. It is the laboratory in which a variety of substances are so altered and prepared by mechanical and chemical agency, as to be capable of entering into the composition of vegetables, and conducing to their growth. All organized bodies are resolved after death, by the chemical process termed putrefaction, into a number of simpler forms, six of which—water, nitrogen, carbonic acid, humic acid, lime, and potass—are essentially necessary for the constitution of plants, and are, therefore, to be found in greater or less abundance in every soil which is capable of supporting them. The first three substances are imbibed by plants from the surrounding atmosphere, besides being furnished by the soil; but the quantity so absorbed by the leaves is trifling when compared with that which is continually assimilated by the roots. Humic acid, on the other hand, is peculiar to vegetable and animal matters, and is indispensable to soils; for, apart from its properties as a nutriment for plants, it is invaluable as being the solvent which enables lime and potass to enter into their composition. Though the agricultural chemistry of these bodies is, to a certain extent, a dull and stale subject, it is necessary that it should be pretty well understood, in order to facilitate the explanation and comprehension of other departments, and, therefore, our time will not be badly spent in taking a short survey of the points most worthy of attention.

The moisture of soils is derived from several sources; it may be formed by the decomposition of organized substances, into an explanation of which process, however, we need not enter; or it may be conveyed to the surface of the earth, either by deposition from the air, as in the case of fogs, dews, and showers, or by filtration through lower strata, as is usual in springs. In whatever way it originates, it serves the important end of holding in solution the other requisites for vegetation: without it, in fact, the other ingredients of soils could not be available. It is not only an indispensable constituent of a soil, but also a principal component of every plant,—23 out of every 25 tons of globe turnips, for example, being calculated to consist entirely of water. The experiments of Du Hamel and Bonnet, who reared plants on moss and sponges moistened with water only, led to the conclusion, that simple water is all that is necessary for their growth; but in these investigations they forgot that the materials of which they had constructed their mimic soil, contained many things which would, unknown to them, be taken up by the fluid, and carried to the plant. A salad can certainly be grown and brought to tolerable perfection in a wetted blanket, and bulbous roots will sprout, and even flower, when aided only by a supply of water; but growth proceeds just so long as the nutritive matter which is contained in every seed and bulb, remains unexhausted, and cannot, therefore, be owing entirely to the moisture.

Water that has been much in contact with the air, is always superior in fertilizing properties to such as has not been incorporated with it. This is owing to water being of itself incapable of serving as food for plants, and only acting as a promoter of fertility in proportion as it contains less or more of other substances. Atmospheric air, together with carbonic acid (a gas which that air always holds in limited quantity,) are of great utility in the economy of plants, and are usually found in combination with water. But the proportions in which these gases unite with water, vary according to their facilities for intermixture; and, as agitation is favorable to their intimate contact, the water of rivers which have run a long and rapid course, is much more beneficial to vegetation, than that which has remained for some time stagnant. Hence the profits to be derived from irrigation are enhanced by causing the water to flow, in preference to allowing it to stagnate on the soil. In addition to these gases, water which has passed through a lengthy channel, holds in suspension various earthy and organic particles, frequently calculated to ameliorate a soil, and to become a source of nourishment to plants. According to Sir H. Davy, (Elements of Agricultural Chemistry, 2 Edit. p. 352,) it may be taken as a general principle, that water containing salts of iron, though possessed of fertilizing effects when applied to soils impregnated with lime, is always injurious to soils which do not effervesce with acids; and that calcareous waters, which are known by the earthy deposite they afford when boiled, are of most use on sandy soils, or other soils containing no remarkable quantity of chalk.

Nitrogen and carbonic acid, though combined with many ingredients of soils, are only found in quantity in the compound termed humic acid. This acid, when resolved by the operations of the chemist into its ultimate elements, is found to be composed of oxygen, hydrogen, carbon, and nitrogen, besides a few saline and earthy matters, which are not considered essential to it. Primarily, it may be viewed as made up of a base called humin, united to the great acidifying principle, oxygen. Humin, or as it is occasionally termed, *vegetable mould*, is a dark-colored unctuous substance, without either taste or smell, which has been found by several French chemists of celebrity to constitute the leading principle in soils and manures. It is formed by the slow decomposition of vegetable and animal matter, and varies slightly in quality according to the nature of the sources from which it has been derived. To it is owing the fertility of soils, and therefore, as we would naturally expect, it is met with in greatest abundance in the earth of gardens, and old well rotted dunghills. Chemistry can avail nothing in the formation of humin, for it is a product only obtainable from bodies that have been at one time possessed of life; and, therefore, it cannot be imitated by the dexterity of man. Every thing gifted with an organized formation is converted, so soon as it has ceased to live, and has been deposited in a suitable locality, in this peculiar matter. The exposure to the atmosphere of dead animal or ve-

getable matter, together with frequent stirring or agitation of any kind, retards, and sometimes altogether prevents, the change which would under opposite circumstances gradually ensue. So long as humin is kept from contact with the air, it continues insoluble and antiseptic. It is consequently almost indestructible when situated a few feet below the surface of the ground, and at that depth is not only found, as in the instance of churchyards, in large quantities, but may also be retained unimpaired for an unlimited period. In such situations, too, it cannot undergo certain changes necessary to ensure its solubility, and it is therefore inert, and totally unfit for the purposes of vegetation. No sooner, however, is it brought by the plough or spade to the surface of the earth, than it begins to alter. Part of its carbon, uniting with the oxygen of the atmosphere, forms carbonic acid, which is readily absorbed by the green parts of plants; while its hydrogen, combining with another portion of oxygen, produces water. "The residue becomes a *soluble extract*, and in that state is taken up readily by the fibres of the roots. But the changes still go on; the extract absorbs more oxygen, and becomes once more insoluble in the form of a film, which Fourcroy calls vegetable albumen, and which contains a small portion of nitrogen readily accounted for. By bringing fresh portions of humin to the surface, and permitting the access of air to it, more carbonic acid, water, extract, and albumen are formed, and give a regular supply to the plants. * * Hence we see the great importance of frequently stirring the surface of the earth." * *—(Penny Cyclopædia, article Arable, which contains an excellent condensation of the views of Thaer, of Berlin, and Theodore de Saussure, of Paris.)

This compound of humin and oxygen *(humic acid)* readily combines with many of the earthy and saline substances found in manures, and renders them of easy solubility in water. *Humates* (as they are termed by chemists) of lime and potass are in this way formed in the soil, and, from the facility with which they are dissolved in water, gain a ready access to the interior of plants. Of this action the old writers were completely ignorant, and therefore puzzled themselves to no purpose in endeavoring to account for the presence of so insoluble a body as lime, in any quantity, in plants. They had, however, a glimpse of the truth, as we cannot identify the substances which they so vaguely treat of under the names of *vegetable extract*, *extractive*, and *mucilaginous matter*, as exactly similar to *humin* and *humic acid*, so ably described by the modern chemists of France and Germany.

The importance of humin to a soil, or rather to the plants which it supports, can hardly be overrated. It is the chief supporter of vegetation, as well as an indispensable solvent of several earths and salts from which plants derive much aid in the progress of their growth. Its mechanical action on a soil is also of considerable moment, serving, as it does, two extremely opposite purposes, that of binding together and consolidating loose sands, and that of breaking up and rendering porous stiff clays. The effects produced in this way by rich manures, capable of affording a large supply of humin, are superior to those resulting from the application of any of the other repairers of a soil. It secures, too, when present in any quantity, a constant supply of moisture to the earth; and as the chemical action detailed above, by which the water is produced, always goes on with increased rapidity in warm weather, it follows that richly manured lands are almost safe from the bad effects of long-continued drought. Too great a quantity of water is, on the other hand, highly detrimental to ground containing much humin, or organic matter from which it can be formed, as fermentation is encouraged, and a compound of an acid and astringent nature produced, which is exceedingly injurious to vegetation. Moss, [peat] for example, is a kind of soil in which this process is constantly progressing. Hence the correct popular opinion that such land is *sour*, and hence the equally correct and well known mode of removing the astringency by draining the land and neutralizing it with lime.

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POINTS IN CHEMISTRY APPLIED TO AGRICULTURE.—SOILS.

No. 2.

Those who undertake to investigate the relations of plants to soils, are embarrassed by peculiar difficulties. They are entering upon a field, the range and boundaries of which are unknown to them, because the confines are, as yet, unpassed: they are groping for deductions, from observations that are as variable and uncertain as the occurrences to which they relate, and which the framers of these remarks would have us to regard as regular and fixed. A store of facts, collected from every quarter of the world, has yet to be amassed. Here and there, doubtless, an incidental observation of considerable value is to be found in the records of our agriculturists and travellers, which is serving as a kernel, round which other fragments will be gathered; but much straggling information has still to be contributed, and much careful reasoning has yet to be expended upon it, and devoted to its arrangement, before these isolated occurrences can be connected and consolidated, so as to serve the important purposes which have been assigned to this species of knowledge, and meet the sanguine expectations which men of talent have, doubtless, been correct in forming regarding it. "In fact," says Mr. Macgillivray, "before any such results could be attained, we should require for data, accurate and perspicuous accounts of all the different countries and climates of the world, viewed with reference to their soils and plants. But of such data do we yet possess even one. The botanist has gone forth by himself, and discovered the vegetation of an unknown region; the geologist has followed in his steps, but he has noted the rocks, and their mutual relations only. None has yet been able to look upon nature with an eye capable of seizing all her features. Humboldt may perhaps be said to have made the attempt, but many Humboldts must run their career before the complicated organization of mundane nature can begin to become intelligible."

Few things would appear, at first sight, easier to be judged of, than the value of a soil, as evidenced by the vegetation on its surface. A particular combination of earths might be supposed to be capable of producing only certain plants, and

therefore, the latter might be viewed as affording a pretty correct index to the composition of the former. Nothing, however, as will immediately be seen, can be more fallacious, as a test of the nature and qualities of a soil, than the herbage it gives rise to. Many plants certainly have each a particular soil, in which alone they appear fitted by structure and habit to attain perfection, and they either thrive or languish, according to the wholesome or hurtful nature of the ingredients which supply their wants; but there are several material circumstances to be taken into consideration, besides the chemical and mechanical constitution of the earths to which they adhere, before we can arrive at anything like conclusions as to the regularity with which particular compositions become the abode of certain species. "The number of plants," says Mr. A. Gorrie, "which may serve as a test for pointing out the peculiarities of soil, is comparatively small; many are found to prosper equally on different soils, and the means which nature employs to cover the surface of our globe with verdure, are so well adapted for accomplishing that purpose, that it affords matter of astonishment to find, in the vegetable creation, an approximation to locality in certain plants, which may enable us to assign to each, its favorite nidus in cultivation, or to distinguish that nidus by their spontaneous growth." It is, therefore, not to be wondered that difficulties of no ordinary kind should be experienced in attempting to fix with certainty the circumstances under which a given plant may be expected to show itself on a particular soil, or that an almost insurmountable barrier should be presented to our progress in endeavoring to discover even a few plants, that will only grow upon one variety of ground. In the vegetable kingdom, we have evidence to prove that certain effects can only, in some instances, owe their occurrence to one, or, at most, two proximate causes—as, for example, where heath invariably indicates the existence of a peat, and where the common whin as regularly points either to a bed of clay, or to one of loam, on a gravelly subsoil; but instances of the kind are rare, compared with the frequency with which plants in general appear to be the result, indiscriminately, of many causes, and to be assigned to no particular soil. Thus, alders and willows seem indifferent as to what may be the mixture in which they fix their roots, provided that a copious supply of water be constantly afforded them, and hence they are found to denote rather the proximity of a lake or stream, than the presence of any one in particular of the usual constituents of a soil.

The limits of vegetables are never so abruptly defined, as to admit of their being spoken of with certainty. Nature does not distribute her productions with undeviating regularity, or with the rigid adherence to boundaries of a practised gardener. We never see one order of plants ranked side by side, over an extensive surface, with another of dissimilar character, yet kept entirely apart from the ground appropriated to its fellow. If soils possessed of peculiar ingredients afforded a hospitable bed for certain plants, but formed, at the same time, an unapproachable barrier to others, we might certainly expect to see their limits at least as well defined as those of the rocks of which these soils are formed; but as plants do not bear unexceptionable relations to particular soils, and flourish, in many cases, on any of a vast variety of mixtures, without apparently evincing a preference, so it is impossible to tie them to a locality, or to assign a distinct limit, beyond which they will not prosper. "From what we know," says Mr. Macgillivray, at the commencement of his *Inferences*, "of the constitution of the world in general, and from what we have observed of Scotland in particular, we are led to infer, in the first place, that soil has little influence upon the nature of the vegetation—this being determined chiefly by climate, and modified by various circumstances, having no connection with the nature of the soil; but that soil has a very considerable influence upon the quality of this vegetation, this influence depending more upon its degree of fixedness, tenacity, and capability of imbibing and retaining moisture, than upon its chemical properties." Chemical constitution, however, must exercise considerable power in determining the nature of the vegetation, as we have already informed the reader, when explaining the character and relations of *humin*, that a soil depends very much for the continuance of its dampness on the quantity of decomposed vegetable and animal matters which it may contain. Those most retentive of moisture, at ordinary seasons, owing to the closeness of their texture, are yet speedily deprived of it on the accession of warm weather, unless they contain within themselves materials, from whose decomposition water can always be produced, and, therefore, such plants as afford a key to the quantity of fluid in a soil, may, with certain restrictions, be looked upon as offering a means of guessing at the nature of its constituents. In another part of his essay, Mr. Macgillivray thus expresses his opinion on this subject:—"The great mass of vegetation, or, as it may be called, the standard vegetation of the country, being diffused over every sort of soil, sandy, gravelly, gritty, clayey, or vegetable, no particular indications are afforded by it of the nature of the soil, unless with respect to its luxuriance, which yet depends upon other circumstances, more than upon the quality of the soil. * * * With respect to luxuriance, the matter is simply thus: Neither the chemical nor mechanical nature of the soil influences the developement of plants further than as they contain the quantity of moisture favorable to particular species or genera; and it can only be by a very complex view of nature that one can attain a knowledge of the suitableness of a soil for a particular species of vegetable."

"Some striking indications," continues Mr. Macgillivray, "nevertheless, present themselves to us in nature. Thus, if, while traversing an extended heath, we observe at a distance a spot covered with fresh verdure, we infer that the soil there is certainly not peat; and if, on approaching it, we see *poæ (meadow grasses)*, *viciæ (vetches)*, and other plants, usually found in rich pasture, we infer that the soil is vegetable, and so of other soils. If, on the other hand, in a rich country, we see tracts, whether of hill or plain, covered with a brown vegetation which we know to be heath, we infer that the soil is peat. Still even among these general appearances, there are few that have direct reference to soil. Thus, on seeing a long line of trees which we know, by their physiognomy, to be alders or willows, we infer that a river flows beside them; but we can make no inference with respect to the soil. And thus,

were it possible that we should be led blind-folded to a spot in which we should open our eyes upon a rivulet margined with bright green moss, among which *saxifraga stellaris* (starry saxifrage) *alchemilla alpina* (alpine lady's mantle), *silene acaulis* (moss campion), appeared here and there, we might assuredly pronounce ourselves in an alpine region; but what the peculiar soil of the spot might be, we would require to remove the turf to discover, and thus trust to the color, texture, adhesion, and other qualities of the soil itself for a disclosure of its nature, rather than to any thing growing upon its surface."

Little reliance can, at best, be placed on a mode of determining the nature of a soil which involves a consideration of so many elements, all calculated fully more than the soil itself to control the vegetation on its surface. All that the most sanguines advocate for the possibility of determining the composition of the soil by the plants which it gives rise to can advance in its favor, may be shortly summed up from the labors of Messrs. Macgillivray and Gorrie; and even the littlet hat those gentlemen have, after much labor, managed to adduce in proof of its utility, tends to diminish the value of the method. As already shown by the extracts we have furnished from their essays, neither of them regard the criteria which they have afforded as certain in their indications, and, therefore, look upon the opinions which they have given to the public, rather as incentives to a further examination of the subject, than as observations of occurrences that are undeviating in their course. Any part of their papers might be selected, in order to afford the reader a knowledge of the connection between certain plants and soils, as what has occurred once, may occur again, and what has fallen under their notice, may at some period or another come under the observation of others; but, as the extent to which the farmer may be warranted in making use of their deductions ought obviously to be determined by the points in which they coincide, we shall only select, in our analysis, those parts in which they have arrived at nearly parallel conclusions. Both Mr. Macgillivray and Mr. Gorrie have seen fit to class the soils to which they refer, under a greater number of heads than is usually thought advisable, and doubtless with a view of giving a precision to their remarks, which would not be otherwise obtainable; but the majority of readers are averse to a prolixity of detail, which some would condemn as a piece of useless straw-splitting; and, therefore, we shall be content to build our remarks on the classification that we have already adopted in our primary division of soils. A tabular arrangement of the plant is employed by Mr. Gorrie, who is by that means enabled to give the maximum and minimum height, in feet, at which each plant is found above the level of the sea, so as to insure a degree of accuracy; but he is very far wrong in assigning so high an altitude to the lowest elevation of several of the plants. He justly observes that—"In ascertaining the elevation, any thing like mathematical accuracy cannot be attained;" but he might have made a nearer approximation to the minimum altitude than he has done. He makes the lowest level of some of the plants as follows. The measurement is given in feet. Common whin, forty; wild mustard, one hundred; bladder champion, one hundred; common rest-harrow, one hundred; scarlet pimpernel, one hundred; eye-bright, three hundred; purple dead nettle, two hundred. Now, those who are in the habit of looking about them, while in the fields, even without having had their attention much directed to botanical pursuits, will agree with us that all these come closer to the level of the sea than what is here stated, and that twenty feet, though still not low enough for most of them, would yet be a nearer approach to the mark. Forty feet is also given as to the lowest elevation of "shepherd's purse," a plant that is frequently found growing upon the shore. These remarks are certainly a slight departure from our subject, but worth attention, as they affect the general harmony of Mr. Gorrie's conclusions.

Clay is scarcely worthy of notice in an agricultural point of view, as it rarely exists in a state of purity at the surface, and, even where it does occur tolerably free from mixture with other earths, is rather to be known by the peculiar scantiness, or entire absence of vegetation, than by any plants which can be shown to be indigenous to it. Mr. Macgillivray and Mr. Gorrie differ more in regard to the indications of clay, than they do in respect to those of any other soil—the latter enumerating no less than twenty-three plants capable of affording an index to this earth; while the former contents himself with allusions to a few varieties of grasses. Both place some reliance on the indications afforded by common colt's foot *(tussilago farfara);* but Mr. Macgillivray, though he admits that it may be depended upon when existing in great profusion by streams, (on whose banks surface-clay is most generally found,) qualifies the observation, by adding, in another part of his essay "I know no plant peculiar to clay-soil; nor is even *tussilago farfara*, for I have often seen it in its natural situation, by running water, in every variety of soil excepting peat, although it is certainly more abundant in clayey, or rather in gravelly soil mixed with clay, than any other."

Sand, when loose and shifting, is devoid of vegetation: but when so situated as to remain for a length of time at rest, it slowly becomes impregnated with vegetable matter, and acquires, in ordinary circumstances, a luxuriant herbage. Along the west coast of Scotland, according to Mr. Macgillivray, this soil gives rise to some of our most valuable grasses and leguminous plants, (plants resembling vetches), on the abundance of which pastures are always dependent for their riches; but in the east of Scotland, there is a decided inferiority in its productions, the whin appearing to choke up and supplant more useful vegetables. "On sandy and gravelly soils," according to Mr. Gorrie, "the broom, as a shrub, is found to preponderate, particularly above free-stone rock;" and "where the sand or gravel is of a calcareous nature, the whin acquires an establishment." In this district, sand, combined with gravel, is usually covered, near pools of water, with species of the willow-tribe, and the yellow water-tris or corn-flag. The gravel mounds in the bendings of the Nith above Dumfries, furnish examples of this combination. "Of the soils which occur in Scotland," says Mr. Macgillivray, "sand and peat are those which are the most distinctly characterized by the plants that grow upon them;" and yet the plants which he speaks of as in a manner peculiar to sand—sea-bent, hollow bed-straw, and common yarrow—are not so much as alluded to by Mr. Gorrie. Broom, in fact, is the

only plant agreed upon by both; and, therefore, is the only one that can be looked upon as affording satisfactory indications; but it is, unfortunately, not peculiar to sandy soil, being also placed by Mr. Gorrie at the head of his list of those which grow upon light black loam on an open sub-soil.

Peat is, in reality, the only soil that carries plants peculiar to itself—its presence being invariably indicated by common ling, fine-leaved heath, and cross-leaved heath; and, though not absolutely essential to the growth of cotton [qu:] grasses, a proportion of it may be looked for in soils on which they are found.

Loam.—"On taking a general view of vegetable soil," says Mr. Macgillivray, "one would be apt to infer that it assuredly possesses a multitude of plants peculiar to itself. * * * But, on more minute examination, we find that many, or most of these, are rather plants of peculiar situations, than plants of vegetable soil, growing in certain places or stations, whatever the soil of those places may be. And, in reality, I do not find a single species that I could name as peculiar to this soil." Both Mr. Macgillivray and Mr. Gorrie bring forward a long catalogue of plants which are found on this soil; and yet *artemisia vulgaris* (mugwort) is the only one that they unite in naming!

The fact is, there is a poverty of information on matters of the kind, which must for a time prevent the drawing of conclusions otherwise than unfavorable to this method of arriving at a knowledge of the main ingredients of a soil. At best, too, the plan promises to be but a rough one, and likely rather to bewilder, than to put those anxious to gain an inkling of the chemical constitution of the ground on the road to obtain it. The farmer is certainly not usually desirous of making a very nice or searching examination, nor is it in general required; but when a soil is suspected, from a failure in the quantity or quality of the crop, to be wanting in something which is essential to the production of a vigorous plant, it becomes a matter of importance to ascertain even by a coarse analysis, the nature and extent of the deficiency. When such is the case, a better mode of procedure than that just detailed, will be to test the soil by a series of mechanical and chemical trials, and having thus found the general nature of its contents, to compare the result with some soil of acknowledged excellence, so as to determine by the contrast the particular ingredients which it wants.

Lengthy processes for the analysis of soils, are described by chemists, with the view of facilitating their acquisition; but the simplest of them require, in their performance, apparatus which few can procure, and a degree of consent between the head and hands that does not fall to the lot of twenty in the hundred. Fortunately, however, these tedious manipulations can be dispensed with in the ordinary run of cases, where the exact quantity in which a particular earth or salt exists in the matter to be tested is not required, all that is necessary to be known being merely—"is this or that ingredient present, or is it absent?"—and where, accordingly, a process, as devoid of prolixity as the information sought for, is better suited to the purpose, and much more likely to be put in practice. On obtaining, then, a sample of earth, the contents of which we wish to estimate, we may make our inquiries in the following manner:—

Has it an earthy smell when breathed upon; or, having adhesive properties, does it retain for any time the form into which we knead or press it? Then it contains clay.

Does it scratch glass when rubbed upon it? Then it contains sand.

Does it effervesce—that is to say, are bubbles of air extricated from it, when a few drops of vinegar are poured upon it? Then it contains chalk.

Does it, when exposed to heat in a small quantity in a shovel or tobacco pipe, exhale an odor similar to that of burnt feathers, or does it catch fire and burn with a pale feeble flame? Then it contains animal and vegetable matters.

Two or three trials with different earths will soon enable the experimenter to obtain, even by this rough method, a tolerable idea of the proportion in which each ingredient exists; and by then comparing the indications he has obtained with the results which professed chemists have arrived at, from the analyses of soils of known fertility, he can form a good notion of the value of his ground, and be in the fair way of remedying its defects. Take for guides the following:—

An excellent wheat soil, from the neighborhood of West Drayton, Middlesex, gave, (according to Sir H. Davy, 2d edit., p. 176,)—

Alumina, (clay,) - - -	29
Silicious sand, - - -	32
Carbonate of lime, (chalk,) -	28
Animal and vegetable matter, -	11

A good turnip soil, from Holkham, Norfolk, afforded, when examined by the same chemist, [eight parts out of nine, silicious sand; and the finely divided matter consisted of]

Alumina, (clay,) - - -	11
Silicious sand, - - -	15
Carbonate of lime, (chalk,) -	63
Vegetable and saline matter, -	8

The fertility of a great many soils of known qualities, subjected to analysis by Thaer, of Berlin, was always in proportion to the quantity of clay, chalk, and humin (vegetable and animal matter,) which they contained; and therefore, according to the coherence when pressed, the effervescence when tested with vinegar, and the odor when burned, will be the value of any soil we may undertake to analyze. This is the sum and substance of the business, and all, in fact, that is applicable under ordinary circumstances. Minute directions for the furtherance of the object might be given, and in a few instances would doubtless prove of service; but the number of cases in which they could be brought to bear upon the subject, would be few indeed, compared with those in which they would serve only to perplex. The benefits that might be derived from the union of chemical *skill* with the observation of agricultural facts, are perhaps incalculable; but how seldom do we find individuals capable, from early training, of reaping advantage from chemical experiments.

[The foregoing articles are upon an important general subject, and contain facts and statements well worth notice and consideration. Still we think that the writer's reasoning, on the most interesting branch of what he treats, is opposed, rather than sustained, by the facts adduced as his proofs.

We have not met with the writings referred to, of Gorrie and Macgillivray, and know nothing of them

except from the quotations and references of this writer; and judging from these, it would seem that they have but very feebly maintained the opinions opposed above, and which we have long believed to be both true and highly important, to both the science and practice of agriculture. This opinion, which we have brought forward frequently in the Farmers' Register, and knew not that it had yet been maintained by any other person, is, *that the presence or absence, or vigor or weakness, of certain plants, furnish very sure indications of certain chemical ingredients or qualities being present or absent in soils.* It may be admitted that *nearly* all plants may grow on soils of almost any chemical constitution. Still, if there are but a few plants, which, with a very great degree of certainty, will indicate even a few of the many usual modifications and characters of soils, these facts, few as they may be, will be highly useful, and the proper *inferences* from them most valuable, though erroneous "inferences" may have been drawn as to other such circumstances, and erroneous grounds for them stated.

This writer, at the very time when condemning these or similar views, furnishes new facts to sustain them. He admits that the growth of *heath* always indicates a *peaty soil;* and though we have never seen a true peaty soil, dry enough for tillage, (—and probably there is not any, dry or wet, in Virginia, except the Dismal Swamp—) we are not the less certain that the heath, if confined to peats, indicates also an *acid* soil, as correctly as does sheep sorrel. If thus, as we maintain, a very few, or even suppose only a single kind of plant, points out this great class of *acid soils*—and shows, that however these soils may differ in other respects, they all agree in requiring calcareous manures to be made profitable—then the value of that information is as useful in practice, as if a thousand kinds of plants served to give the same indications. But it is not only that peaty and acid soils are pointed out so unerringly. We incline to believe that the presence of calcareous earth is clearly pointed out by some plants' growing and thriving spontaneously—and it is certain that other plants mark soil, if not absolutely *calcareous*, at least *neutral*, or freed, by the admixture of a sufficiency of lime, from the acid principle which prevails in, and destroys the value of peat soils, and all the ridge, or other naturally poor lands of lower Virginia, in their natural state. Red clover may live, but cannot thrive on an acid soil—and further, we believe that some gypsum is essential to its healthy existence, and that its vigorous growth proves the presence of that earth in the soil, as well as of enough lime in some other form to have prevented the existence of free or hurtful acid. There are plants which will grow only on a soil containing enough salt to be hurtful to most other plants, and their presence of course shows a very salt soil.

But these ingredients of soils, which some plants so unerringly point out, are such as act chemically. Such as act mechanically, or at least principally so, do not afford any such evidence of their presence, or quantity. It is this distinction which the writer above does not perceive, and for want of which his reasoning is confused, and does not reach the conclusion to which his facts direct.

All soils, unless absolutely barren, must contain some small portion of each of the three principal earths, viz: silex, (pure sand,) alumina, (the pure matter of clay,) and lime, in some combination—(though the usual form, *carbonate of lime*, is seldom to be found in soils in this country, except in the western *prairie* soils—) and, therefore, all the three earths being present, either in large or small proportions, in every soil, of course, no plant can be supposed to indicate *precisely* the presence or absence of either. The abundance or scarcity of either of these three earths is, in most cases, indicated plainly enough by the plenty or scarcity, the vigor or the feebleness, of many different kinds of plants, and especially in a state of nature; but still, all such may *live*, and perhaps *thrive*, on any of these soils. Further—so far as the earths which compose soils act *mechanically*, the greatest abundance or scarcity of either may not be proved by the absence or presence, or feeble or vigorous growth, of any particular plant—because the favorable or unfavorable quality may be compensated for by some other kind. Thus, every farmer knows that a clay soil is the best for wheat, and that a great excess of silicious sand is so unfavorable to that crop, as generally to forbid its being profitably raised. Nevertheless, enough of calcareous and putrescent matters added to very sandy soils, serve to produce very fine crops of wheat. Of this, a striking example was made by the liming and vegetable manuring of the late Fielding Lewis, on his very sandy land of Weyanoke, on James River. For these several reasons, we can grant to the writer so much as this—that the presence or even vigor of particular plants will not unerringly point out whether either the silicious or the argilacious portion of a soil is too great or too small—nor even whether the calcareous part is small, or excessive. The sandy (silicious) and argilaceous parts of soil act almost entirely mechanically—and so does all the calcareous earth, after enough has acted chemically to neutralize or prevent the formation of the acid principles. Therefore, the vegetable growth might not show any certain difference between soils containing 5 per cent. and 50 per cent. of the pure matter of clay—or 50 and 90 per cent. of that of sand—nor between 2 and 20 per cent. of carbonate of lime—because all the quantities between these named extremes would act merely mechanically. But yet there would be the most striking and sure indications of the difference of composition between the soil containing even so little as one-thousanth part of carbonate of lime, and any other having not enough lime to neutralize the acid of the soil. In this case, the action is not mechancal, but chemical—and the smallest perceptible proportion of *carbonate* of lime being present, shows that there is so much superabundant, after its having performed all the chemical action necessary. In this manner, the soil containing the smallest perceptible ingredient of *carbonate* of lime, in a state of nature, would prevent the growth of larch trees, (as stated above in the limestone soils of

the Alps,) as effectually as fifty times that proportion. Just so, no pine grows on the limestone soils of Virginia and Kentucky, though there is generally only enough lime in them to *neutralize* the soils, and not enough to leave the smallest excess of lime in the form of *carbonate*. And the smallest deficiency of lime, below the amount necessary to neutralize the whole acid principles of the soil, permits that necessary food to be furnished to the larch, pine, and sorrel, and of course, permits their growth, wherever the climate is not too unfavorable.

So far as our yet few and imperfect lights extend on this subject, we should rely on the most sure vegetable indications of acid and neutral soils, with as much confidence, as on the analyses of the best chemists, and far more so than on any ordinary experimenters. The rules given by this writer, for partial analyses of soils, and which he deems preferable, and sufficient, are of no value; as almost every cultivated soil contains enough silex to scratch glass—enough clay (or alumine) to be kneaded, or made into a lump when moist—and, in his country, (England,) most soils are enough calcareous to effervesce with acids; though in Virginia scarcely any are so. Therefore, soils of all possible grades, and the most different qualities, might be tried by his tests, and found to give the very similar results.

There is, as yet, but little known on this subject. But however few the known facts, they are not the less important, and the inducement is great to men of science to pursue the investigation. Ed. Far. Reg.]

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STUDIES IN THE SCIENCE AND PRACTICE OF AGRICULTURE, AS CONNECTED WITH PHYSICS.

* * * * *

Nutritive principles of animal food contained in grain and roots.

Towards the end of the 17th century, the illustrious Dutch observer Leeuwenhoeck, in his microscopical researches, examined, amongst other things, portions of wheat flour, which we now know to consist of a various mixture of starch, gluten, oil, resin, sugar and gum; and by one of those happy chances already exemplified, was led to make a shrewd conjecture respecting the real constitution of flour made from grain. In the wheat flour he found globules (*globuli farinarii*,) each as he supposed, furnished with a vessel, by which the plastic matter passes in order to produce globules,—an optical illusion, as has since been shown; but in subsequently studying those globules, he shrewdly asks whether they be not enclosed, as in the case of seeds, in some sort of membrane. "I then," he adds, "used my utmost endeavors to discover the internal hidden make of the globules of meal, wherein, at length to my great satisfaction, I succeeded."* He describes the grains of wheat as principally composed of those minute globules which are singly transparent, and lie closely compacted within a kind of membranes, so exquisitely thin and transparent, that in some places their texture is not to be discerned. M. Biot has said, that Leeuwenhoeck observed the grain of fecula (rather farina) to be composed of a vesicle and a soluble substance, which is its nutritive part, since nothing but the shells or husks are met with in the dung of animals.

Now these observations of Leeuwenhoeck were lost sight of, as that of Huygens had been relative to the polarization of light, till, eight or ten years ago, the subject was taken up by M. Raspail, apparently without being aware of what Leeuwenhoeck had published, and he has so simplified the views of the constituents of the nutritive principles contained in farinaceous substances, as to render them, when conjoined with the researches of Biot, Persoz, Pelouze, and others, of the highest interest to scientific agriculturists.

It may be remarked, in passing, that M. Raspail endeavors to shew that Leeuwenhoeck's observations afforded not even a glimpse of his own discoveries, and that M. Biot has misunderstood or misrepresented his meaning. In the quotations from Leeuwenhoeck above, however, which we have given in Hoole's excellent translation, it will be seen that M. Raspail himself has not translated unbiassedly. Hoole was dead before Raspail's discovery. From the experiments of M. de Saussure, it was believed that he had procured the chemical basis of starch, which he termed *amedine*. This amedine may be procured by boiling starch in a large quantity of water, throwing it on a double filter; and by boiling again the matter remaining on the filter, filtering again, and drying the residue. The substance thus obtained, after repeated washings and dryings, is in irregular white or yellowish-white fragments, very friable, and without taste or smell. M. Saussure said this formed with potass a non-viscid solution, was insoluble in water below the temperature of 140°, and did not form a jelly with boiling water. But M. Raspail shows, that what was supposed to be a solution in water at 140°, is only a suspension. Saussure failed most signally in discovering the nutritive basis of starch, which he ought to have sought for, not on the filter, but in the liquid which had passed through the filter.

Berzelius is no less in error than Saussure, when he states, as quoted by M. Raspail (*Chimie Organique*), that starch or fecula is composed of small crystals, which partly dissolve in water at an ordinary temperature. On the contrary, the microscope shows, that starch or fecula is composed of shining white smooth globules, quite insoluble in cold water, even when immersed for any length of time.

The globules of starch, indeed, consist of an envelope or shell, and a kernel, if it may be so called, of a substance very different,—the chief discovery of M. Raspail, which serves to explain the errors and discrepancies of previous observers; for the envelope is altogether insoluble in cold as well as in boiling-water, and it is only what we shall for the present term the kernel that is at all soluble. The partial solubility, therefore, observed by Berzelius, must have arisen from the accidental rupture of some of the envelopes by which means the water could obtain admission to the kernels.

Accordingly, when Berzelius states that starch is dissolved into a mucilaginous liquid by boiling

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*Hoole's Select Works of Leeuwenhoeck, p. 179.

* Chimie Organique, *sub fin*.

water; Thenard, that fecula combines easily with boiling-water, forming a hydrate popularly termed starch; and Despretz, that, when fecula is mixed with boiling-water, it becomes soluble, and does not recover its insolubilty in cold water, when evaporated to dryness,—they all speak vaguely, and in part incorrectly, from not knowing the discovery of Raspail already mentioned. The kernel contained in the globular envelope of fecula, consists of a gum-like matter, which, by the evaporation of its watery parts, becomes hard on exposure to the air. When immersed in water at 122°, the envelope, which is unaffected by colder water, expands, and in boiling-water it bursts, while the kernel is dissolved in the water.—When the water is in large quantity, the envelopes detached from their kernels, and now ten times their original size, having free motion, subside; but when the quantity of water is small, they become mutually entangled, form jelly-like strata or layers, and render the water thick,—being what is termed starch in the laundry (*empois*).

M. Raspail, from numerous experiments, concludes, that each grain of fecula is an organized globule, formed in the interior of living vegetable cells, such as in those of a grain of wheat, or of the tuber of a potato; that the enveloping membrane of the kernel is incapable of being dissolved in cold water, spirits of wine, ether, or the acids, but expanding in proportion to the degree of heat, and in boiling-water bursting on one side of the globule; and that after boiling in a large quantity of water, the burst and detached envelopes fall to the bottom in the form of snow-white flakes, leaving the liquid above them as limpid as water.

With respect to the kernel contained within the evelopes, M. Raspail concludes, that if the limpid liquid be cautiously poured off, the addition of spirits of wine, the concentrated acids, or tincture of galls will coagulate it, but will not coagulate by heat; that it acquires a blue color by adding iodine, a property it possesses in common with the envelopes, but it loses this property by being spread out thinly on a porcelain plate and dried, differing in that case in no respect from gum; and that it does not lose its characters on being dried by a moderate heat, which causes it more to resemble gum with a glass-like fracture, a splintery texture, and a shining surface.

We have M. Raspail's authority, then, for considering the kernel within the envelopes in starch as resembling gum, if not identical with it in physical and chemical characters, and hence we might be led to believe that the nutritive or soluble part is gum, or of the nature of gum. At this stage of the inquiry, however, M. Biot, along with M. Persoz, took up the subject, and succeeded so far in discovering a distinct and very remarkable difference from gum. Accordingly, on isolating the kernel portion of the parsnip root, by boiling to burst the envelopes, precipitating by alcohol, purifying by repeated washings with alcohol, and then dissolving it in water in order to observe in what manner it polarized light, it was found that it turned the planes of polarization with more energy towards the right than any substance yet known; while all gums, and the sugar of grapes, turn the planes of polarization towards the left. Cane sugar, indeed, turns the planes of polarization towards the right, but not with the same energy as the kernels of starch. The latter, therefore, MM. Biot and Persoz term *dextrine*, and we shall adopt the term, notwithstanding M. Raspail objects to it, till one more appropriate be proposed. The soluble portion accordingly of starch, or the farinaceous matter of grain and roots, is dextrine, which is always contained in a globular envelope, composed of membranes that are incapable of being dissolved in water even when boiling. By means of this singular and unexpected test of turning the planes of polarization towards the right of the observer, the nutritive qualities of all vegetable substances can be examined, and many of them have been so examined by M. Biot, as we shall presently see. Amongst other vegetable productions, M. Biot examined the juice of the carrot, taken from the white variety, by cold pressure. He divided this into two parts, one part being filtered through white paper without being heated; and another, after being similarly filtered, was brought for an instant to the boiling point. The result was most important in a practical point of view; the part which had been brought to a boiling temperature produced a rotation towards the right exactly double of that which had not been heated, and its absolute intensity corresponded to the proportion of four per cent. of cane-sugar, as deduced from previous observation.

"The liquor," continues M. Biot, "treated with alcohol, gave a considerable precipitate, which was instantly re-dissolved in water, as the case with dextrine, and this appears to me to explain sufficiently the sudden increase of the rotation after the boiling." It will follow that even a slight boiling doubles the nutritive quality of carrots, a fact known indeed from other experiments but only in a vague manner, without any philosophical data to explain it by.

The juice of the turnip exhibited similar phenomena. When it was procured by simple pressure and filtered through paper, the portion which passed the filter exercised no rotation that could be appreciated; but on boiling it with the pulp a liquid was obtained, which turned the planes of polarization towards the right, indicating cane-sugar, as found in the turnip by chemical analysis.

In the juice of the beet-root; so interesting on account of the increasing manufacture of sugar from it, M. Pelouze, a young, but able chemist, having found no grape-sugar, or such as is incapable of crystallization, and only crystallizable sugar, M. Biot undertook experiments to investigate the subject still farther. Taking the fresh juice of the beet-root, he repeatedly measured with the greatest care the intensity of rotation which it communicated to polarized light, which he found to vary from 10° to 12° 6′, according to the difference of individual roots, or different parts of the same root, indicating from 11 to 14 per cent. of cane-sugar. The crown and the sides of the root being less mature than the centre, appeared to him to be less rich in the proportion of nine to ten. As the beet-root on which the experiments were made had been taken from a field very liberally manured, the large proportion of saccharine matter, indicated by the intensity of the rotation, confirmed the remark of M. Pelouze that the richness of the manure did not diminish the constitu-

ent quantity of sugar, though it renders it more difficult to preserve the roots. M. Biot seems to think that the large proportion of sugar might likewise be partly accounted for by the summer having been dry and hot. There did not appear to be any dextrine, for the white precipitate, perfectly soluble in water, and not coagulable by heat, did not affect the planes of polarization at all, and consequently this precipitate was neither albumen, gum, nor dextrine.

Dextrine was procured by MM. Biot and Persoz from laundry starch (*empois*) by acids cold or hot, strong or diluted, by potass, or by hot water, any one of which will rupture the envelopes, and set free the dextrine. Water alone, however, as M. Raspail proved, and MM. Biot and Persoz verified, will not completely rupture all the envelopes of fecula, or at least extract all the dextrine, unless the boiling is continued for a long time with considerable quantities of water; because the unbroken globules of fecula are apt to be held together in clots by the gum-like matter disengaged from the broken ones, and in this manner are partly protected from the full influence of the heat.

The dextrine thus obtained by any of the foregoing agents is uniformly the same, being completely decomposable by heat, while it can be analyzed into water, hydrogen, and carbonic acid gas, but no nitrogen has been found in it. When treated with yeast, it undergoes the vinous fermentation, while acids change it into a saccharine syrup; but when tried by the rotatory polarization of light, this syrup has a greater power in turning the planes towards the right than the sugar of starch, in the proportion of ten to three.

Varieties in the unburst globules.—Before the application of heat or any other agent to rupture the envelopes of the globules and set free the soluble dextrine, the globules themselves afford interesting objects of investigation, as will appear from the following important statement of M. Raspail. He tells us (*Chimie Organique*, 134,) that in the Paris market he seldom found any wheat flour not to a certain extent mixed with potato starch, by which mixture the fraudulent dealer gains as much as 25 per cent. The potato starch has scarcely any effect on the appearance of the flour, and it requires experience and skill to detect it by the naked eye, unless the quantity of starch be considerable, when the crystalline appearance of the flour gives room for suspicion. The fraud, however, is readily detected by the microscope, and M. Raspail says he could thus discover the starch if it constituted only one per cent. of the flour. In examining suspected flour, it is always more easy to pronounce that it is adulterated than to tell in what the adulteration consists. The dimension and form of the globules, as given by Raspail, are the chief means by which such examinations can be made, and we think that no extensive dealer ought to neglect making himself thoroughly acquainted with these. He has only to furnish himself with a common microscope, and a micrometer or glass plate divided by very minute lines like a foot-rule, and by laying a grain or more of flour on the micrometer, and examining it with his microscope to see how many lines it covers, he will be enabled at once to tell the quality and kind of the flour in question.—Micrometers divided so as to measure the $\frac{1}{10000}$th part of an inch may be employed.

Potato.—The globules containing dextrine in this root acquire a larger size than any hitherto examined, being usually of from the $\frac{15}{10000}$th to the $\frac{4}{1000}$th part of an inch, or even the $\frac{49}{10000}$th part of an inch. When fresh, they exhibit on the surface concentric wrinkles which disappear on drying. The form of these globules, when large, is oval; when small, more spherical, the former being slightly contracted, and bluntly triangular.

Wheat.—The largest globules rarely exceed the $\frac{2}{1000}$th part of an inch, or about half the size of the largest potato globules. They are of a round or spherical shape, and are much smaller when taken from half ripened wheat.

Barley.—The globules of barley are similar in appearance to those of wheat, but are much smaller, rarely exceeding the $\frac{98}{100000}$th part of an inch.

Oats.—The globules of oats are oval and yellowish, being from the $\frac{276}{100000}$th to the 118-100,000th of an inch in diameter. The innumerable minute hairs of this grain give the meal a sort of cottony appearance to the naked eye.

Rye.—These globules are about the 2-1000th part of an inch in diameter, of a flat form, somewhat sharp on the edge, and marked with a black cross or three black rays forming a central star, which gives a black color to rye flour.

Arrow-Root.—The genuine arrow-root from Brazil may be distinguished from the starch of potatoes by boiling, which only produces in arrow-root an enlargement of the globules to four times their original diameter, because, as M. Raspail thinks, they are exposed to heat in the original Brazilian preparation, while the globules of the potato expand to twenty or thirty times their original diameter, The largest globules of genuine arrow-root do not exceed 16-10,000th part of an inch, and, like those of rye, exhibit through their translucid surface black lines like a star, or sometimes like the letter T. Potato starch is better than the genuine arrow-root.

Buckwheat.—The globules are yellow, and seldom appear so large as the 4-10,000th part of an inch.

Maize.—Few of the globules attain the size of the 98-100,000th part of an inch. The dried fecula is usually injured by grinding, being folded, wrinkled and more or less rounded. When taken from the half-ripe milky grain, they are smooth, entire, and quite round. Hence the dextrine of maize is obtained in greater proportion from the half-ripe seeds; and hence also the small proportion of starch found by the usual modes of chemical analysis, though it actually exist in the grain.

Peas.—The globules of peas are of the same form as those of the potato, with an unequal surface, and the largest are about the 2-1000th part of an rich.

Beans.—The globules are of the same size as those of peas, but differ from being egg-oblong, or kidney-shaped, sometimes appearing as if a smaller grain were enclosed in the interior.

Other globules were examined and measured by M. Raspail, but these are the most interesting for our present purpose, and, before proceeding farther, it is indispensable to impress upon the attention of the reader,

1st, That the globules constituting meal, flour, and starch, whether contained in grain or roots, are incapable of affording any nourishment as animal food till they are broken.

2d, That no mechanical method of breaking or grinding is more than partially efficient.

3d, That the most efficient methods of breaking the globules, is by heat, by fermentation, or by the chemical agency of acids or alkalies.

4th, That the dextrine, which is the kernel, as it were, of each globule, is alone soluble, and therefore alone nutritive.

5th, That the shells of the globules, when reduced to fragments by mechanism or heat, are insoluble, and therefore not nutritive.

6th, That, though the fragments of these shells are not nutritive, they are indispensable to digestion, either from their distending the stomach and bowels, or from some other cause not understood, it having been proved by experiment that concentrated nourishment, such as cane-sugar, essence of beef, or osmazome, cannot long sustain life, without some mixture of coarser and less nutritive food.

7th, That the economical preparation of all food containing globules of fecula, consists in perfectly breaking the shells, and rendering the dextrine contained in them soluble and digestible, while the fragments of the shells are at the same time rendered more bulky, so as the more readily to fill the stomach.

We hope these principles have been here put in intelligible and unequivocal language, so that they may not be misunderstood, seeing that they are of the very highest practical importance, in preparing the food of all live-stock as well as of our own. But lest some of our readers of the old school, who are apt to reject most novelties as theoretical, should refuse to admit the truth of the deductions, it may be well to corroborate the results from actual experiments made by those who were ignorant of the very existence of the globules described by M. Raspail, or the dextrine of M. Biot.

Experiments on feeding.

Some of the most instructive experiments upon the feeding of farm-stock with different materials, were made by an intelligent foreign agriculturist, M. Mathieu de Dombasles, and published in a work little known in this country, the *Annales de Roville.* The experiments usually made on this subject have been conducted upon the principle of continuing one species of food, such as hay or carrots, for a given time; but M. de Dombasles reflecting that it is neither natural nor agreeable to any animal to be confined for a length of time to the same species of food, adopted a different method. He separated into several groups the cattle on which he designed to experiment, and brought those in each group as nearly as possible to a given weight, by feeding them with an exactly weighed proportion of common articles of food, diversified to suit their taste. When he had proceeded so far, he then began to take away from their diversified food a known proportion of one of them, such as lucern hay *(luzerne séche,)* replacing it by some sort of root, such as carrots, gradually increased or diminished, so that each individual in the group came up to and sustained the weight it had stood at before the change. The comparison of the quantities thus ascertained by trial to be equivalent, gave the practical proportions of their nutritive properties, under the conditions thus associated.

The results thus obtained by M. de Dombasles by trials with sheep, appeared to place carrots very far below the rank usually assigned to them as food for sheep by farmers on the continent, and even as food for horses, when substituted for grain. But it is important to remark, that M. de Dombasles gave the carrots in a raw state to his sheep, and consequently from their stomachs being unable, in the process of digestion, to cause the globules in the carrot containing the dextrine to burst, they derived little nutriment from a substance which is undoubtedly very nutritive when the dextrine is developed by boiling. The intelligent farmers in Belgium, who seem to be almost a century before other parts of Europe in improvement, never, it is said, give any roots to their live-stock without boiling.

The digestion of food is in all animals partly a chemical and partly a mechanical process, and varies much in different animals, even when they feed on similar aliment; for example, the rabbit, the horse, and the game-cock, when fed upon oats or barley. The horse, and even the rabbit, when fed on oats, swallow many grains without crushing them with their teeth, and their stomachs not being endowed with the power of digesting solid uncrushed grain, it is voided whole, and so little changed as frequently to be capable of germinating. In the case of the game-cock, again, and all gallinaceous fowls which feed on grain, it is uniformly swallowed whole, their bills not being adapted for bruising it, like the teeth of the horse, nor for shelling it, like the linnet and sparrows. But the gizzard of these fowls has not only sufficient power to crush oats and barley, but even, as Spallanzani proved, to reduce glass to powder; yet, with all this power, so very much greater than the digestive powers of the horse, poultry cannot, as will be immediately proved, completely extract the dextrine from grain, unless assisted to do so by artificial means, besides their powers of digestion. The celebrated M. Reaumur undertook a series of experiments on raw and on boiled grain in feeding, which, though made long before the discovery of dextrine, strongly corroborate the views of MM. Raspail and Biot, the more so, indeed, from M. Reaumur's non-acquaintance with the principle.

The farmers in France who keep poultry, have long been in the habit of cooking the grain given to fowls which they intend to fatten, boiling it in water till it is soft enough to be easily bruised between the fingers, the heat causing it to swell till the mealy portion of the grain splits the chaffy envelope, and this they term bursting. It is therefore the popular opinion, that boiled grain is more nutritive and fattening than raw grain, an opinion founded, however, upon vague notions, which M. Reaumur endeavored to base upon precise calculation.

Boiling of grain.—For this purpose M. Reaumur caused about four measures (each $1\frac{1}{2}$ pints English, or $\frac{8}{9}$ths. of a chopin Scotch) of each of the six common sorts of grain, to be boiled till they were well burst, (which may be fairly taken to mean that two-thirds of the dextrine was set free), and he found that the increase of bulk in each sort was as under:—

Four measures of oats, after being boiled to bursting, filled	7 measures,

Four measures of barley, after being boiled to bursting, filled 10 measures.
Four measures of buckwheat, or brank, after being boiled to bursting, filled 14 —
Four measures of maize, after being boiled to bursting, filled above 13 —
Four measures of wheat, after being boiled to bursting, filled little more than - - - - - 10 —
Four measures of rye, after being boiled to bursting, filled nearly 15 —

Rice swells considerably more than any of the preceding, but was not measured.

In order to ascertain whether the boiling altered the preference of poultry for any of the particular sorts, M. Reaumur made experiments, varied in every possible way. The fowls were furnished with two, three, four, five, and six different sorts, sometimes all the compartments of a feeding-box being filled with burst grain, each division different from another, and sometimes each sort of grain filled two of the divisions, one having nothing but boiled, and another nothing but dry, unboiled grain.

All that could be inferred from these repeated experiments was, that the greater number of fowls prefer boiled to raw grain, though there are many of them which show a preference to the raw grain on certain days, and no permanency could be discovered in the preference shown for any sort of burst grain. Some fowls, for instance, which one day preferred boiled wheat, would, on other days, make choice of buckwheat or maize, oats or barley, and sometimes, though more seldom, even of rye; but rye, either boiled or raw, is their least favorite sort of grain.

It follows, as an important practical conclusion from such experiments, that we may make choice of the sort of grain which happens to be cheapest to feed poultry, without much if any disadvantage, always excepting rye, when other sorts are to be had on reasonable terms.

It required experiments of a different kind to prove whether there is any economy, or the contrary, in feeding poultry with boiled grain, and this was readily ascertained by finding first how much dry grain sufficed one or more fowls, and then boiling the same quantity, and trying how much of that would in like manner be sufficient. The experiments which, for this purpose, M. Reaumur made with the different sorts of grain, were as follows:—

Rye.—Although, as we have seen, rye is very considerably increased in bulk by boiling, so far from being more sufficing, it becomes less so; for fowls will eat rather more of it when it is boiled, than when it is raw and dry. Seven hens and a cock, which consumed only three-fourths of a measure of dry rye in one day, ate in the same time three measures of the boiled grain. Consequently, as three measures of boiled rye are equivalent to four-fifths of dry, it would cost one-twentieth more to feed fowls with boiled than with dry rye, four-fifths being one-twentieth more than three-fourths. The globules of rye are almost the same size, according to M. Raspail, with the globules of wheat.

Oats.—It appears, that although oats are increased by boiling nearly one-half, they are not, any more than rye, rendered more sufficing as food; for the fowls, which, in two days, would have eaten four measures of dry oats, consumed in the same time several measures of the boiled grain. Consequently, so far as fowls are concerned, it is no saving to boil oats; though this does not prove that the same holds with regard to horses, whose powers of digestion are so inferior to those of fowls.

Buckwheat or Brank.—This grain is increased by boiling still more than oats, since four measures when well boiled, swell to fourteen. Notwithstanding, there is little advantage obtained by boiling it for fowls, as they will consume the fourteen measures of the boiled grain nearly in the same time which the four measures of the dry grain would have sufficed them.

Maize or Indian Corn.—This grain is more profitable as food for poultry when boiled than when raw; for the fowls, which would have eaten a measure and a quarter of dry maize, consumed only three measures of the boiled grain, and these three are not equivalent to one measure of dry maize. But it is worth remarking, that the fowls experimented upon continued only for two days able to get through three measures a-day of the boiled maize. After this time, they either lost their appetite, or came to dislike the food, since they could not then eat quite two measures of the boiled grain. Now, calculating that they had continued to eat even as much as three measures of boiled maize a-day, there would be a saving of more than one-fifth; and if they were satisfied with two measures, the advantage would be much more considerable, inasmuch as this would not be equivalent to two-thirds of a measure of the dry grain. The saving in this case would be one-third and one-fifth, that is eight-fifteenths, or more than one-half.

Barley.—This grain also was found, upon trial, to be much more economical when given to poultry boiled than raw. Fowls, which would have consumed two measures of the dry barley a day, got through only three measures daily of the boiled grain. Now, as ten measures of boiled barley are produced from four measures of dry, three measures are, therefore, equivalent to no more than six-fifths of a measure of dry. The expense, consequently, in dry barley is to that of boiled as ten-fifths to six-fifths, that is, as ten to six, or as five to three, showing a saving of two-fifths by feeding poultry with boiled instead of dry barley. This result is, no doubt, owing to the more effectual bursting of the grains of fecula, and setting free the dextrine contained in them.

Wheat.—The results of the experiments on boiling grain given above, show that wheat increases in bulk about the same as barley; but the experiments made on feeding poultry were considerably different in their results, the saving not being near so much with boiled wheat as with boiled barley; for the same fowls which consumed three measures of boiled barley in one day ate three measures of boiled wheat. Now, three measures of boiled wheat are not equivalent to two measures of dry wheat, but only to a measure and a half of dry wheat, the quantity consumed in one day by the same fowls. But as a measure of boiled wheat is equivalent to no more than two-fifths of the measure of the dry grain, the three measures eaten in one day are equivalent only to six-fifths of dry wheat, and therefore the proportion of what they consumed of dry wheat, was to what they consumed of the boiled as fifteen-tenths to twelve-tenths, or as five to four; hence there is a saving

of one-fifth by feeding with boiled wheat, as there is of two-fifths with boiled barley.

It is clearly proved, then, by these interesting experiments, that there is in most cases a considerable saving by feeding with boiled grain. It would be well if some intelligent gentleman would undertake similar experiments on feeding horses and cattle with boiled or steamed grain or meal. The advantage of feeding with crushed grain, instead of given it unbroken, has been very satisfactorily proved and acted upon by Captain Cheyne (*Quarterly Journal of Agriculture*, iii. 1024, and iv. 378), and recommended by Mr. Dick and others. The steaming of potatoes is well known to be advantageous in feeding both horses and cows,* and more particularly in causing hens to lay, and in fattening pigs. Why should not the various sorts of grain, such as peas and beans, and meal, such as barley meal, given for similar purposes, not be advantageously increased in their nutritive properties by the same means? The expense of fuel, though it ought to be taken into account, must be small in comparison with the advantage, at least in districts where coal or other fuel is reasonable in price. In large concerns, also, the expense of fuel would of course be proportionally less when compared with the saving in food.

Bread-making.—The most complete method hitherto discovered for bursting all the globules of fecula, is the usual process of making bread, or, as chemists term it, *panification*. This arises from the presence in wheat flour of a substance termed gluten, associated with the globules of fecula, and constituting in the unbroken grain its cellular texture or frame work. It would lead us too far from our present object to go into the history of this important substance minutely, but it may be necessary to state, that the gluten may be procured by kneading and washing a piece of dough, made with wheat flour, in a stream of water, till all the globules of fecula are washed out. The gluten thus obtained is a greyish mass, elastic, like Indian rubber, when moist, and incapable of being dissolved in water. It is these two properties which render it so important in bread making.

When a loaf is put into the hot oven, the steam and gases expand within it, and raise up the elastic gluten into bladder-like vesicles; and by this means expose the globules of fecula in the dough more uniformly to the heat than could be effected without such agency. In consequence of this they burst; and in a well-baked loaf of bread not a single unburst globule of fecula can be found. On the continent this is practically understood in the districts where they feed their horses chiefly on bread, as in most parts of Belgium, Prussia, and Switzerland. The bread thus given to horses is coarse, dark-colored, and rather sour, from leaven being employed instead of yeast; but the partial fermentation caused by the leaven must assist in bursting the globules and setting free the dextrine from the action of the acid thus developed.

According to M. Raspail, and the fact has been stated by others, the more of other fecula we mix with good wheat flour, containing its due proportion of gluten, the less increase of weight does the bread acquire. For example, six pounds of flour will produce eight pounds of bread; but if three pounds of potatoe-starch be mixed with three pounds of wheat-flour, instead of eight pounds of bread, there will only be six pounds. He explains the circumstance from the globules of fecula while unbroken, not imbibing water, but being only moistened by its adhering to them; while the gluten sucks in water like a sponge, and the more it is kneaded, the more water it will take up. The mixture, therefore, of other flour with that of wheat diminishes not only the weight, but the nutritive materials in the bread.

Nutritive Principles of the Food of Plants.

It is stated in most elementary books, that the chief food of plants consists of carbonic acid gas diffused in water, together with potass and some other matters apparently not well understood. But a plain agriculturist not acquainted with science, will very naturally ask how this is proved. By burning plants, indeed, he knows that charcoal (*carbon*) and potass may be produced; but in that case, these are in a very different state from the one in which they exist in the growing plant. M. Lassaigne, the able Professor of Chemistry at Alfort, devised the ingenious experiment of analyzing the chemical constituents of seeds before and after germinating, and in this way arrived at one method of proof of the facts just stated; yet the plain farmer who might have witnessed such analysis, would readily make a similar objection to it with that of procuring charcoal and potass by burning, namely, that it was an artificial process, and therefore calculated to change the state of the substances discovered.

In order to elucidate these points, confessedly difficult and obscure, M. Biot undertook the investigation, by applying his newly discovered and powerful test of the rotatory polarization of light. Before giving any details of Mr. Biot's experiments, however, it may be well to state the views of M. Raspail respecting the imbibition and flow of the sap, these being rather novel as well as probable.

Circulation of the Sap.—All growing vegetable textures are composed of cells, every where closed, containing a fluid, which is in continual motion so long as the temperature is above 32° Fahr. The cells adhere to one another, or rather are fixed to one another by a sort of root or pedicle (*hilum*), often too minute for observation; and it is this, and the globules of the cell, which, being lengthened out and expanded in the progress of growth, give origin to new parts, or to the enlargement of old ones.

The circulation of the fluid in the cells, originally discovered by Corti in the *Chara*, cannot be observed when the cells are opaque, or the fluid transparent; but an idea may be formed of it by filling a tube with spirits of wine, having some raspings of cork in it, and holding it in the hand, when the heat of the hand will cause a current to rise from the bottom up one side of the tube, and the cold at the top abstracting the heat from the particles as they rise, will cause an opposite current to descend

* According to the experiments fully related in the 10th and 11th volumes, pages 253 and 52, of the Transactions of the Highland Society, it would appear that cattle thrive as well on raw turnips and potatoes as on prepared, and yield more profit. The point has not yet been sufficiently experimented on. But we have no doubt that boiled corn would fatten cattle better than raw.—EDITOR.

on the other side. The difference of the vegetable circulation from this experimental one, consists in its being caused by a living principle, and not heat, though a certain temperature is indispensable. M. Raspail terms the operation of this principle in circulating the sap, *aspiration* (meaning by this something like suction or attraction), and *expiration* (meaning something like expulsion or repulsion), the sides of all the cells of growing plants alternately aspiring and expiring, or attracting and repelling fluids.

The membranes of plants, as well as the cells composing them, aspire and expire fluids; and when these membranes form a tube with branches more or less composed of net-work or reticulations, the fluid forms one continuous current in every part of the tube.

The stems and branches of all plants are formed of cells, which from having been originally globular, expand by growth; and by the pressure of other cells expanding around them, take a wedge-like shape, the thin portion forming their point of attachment, or pedicle *(hilum.)* The membranes thus formed may be conceived to sheath each other, the inner sheaths being inserted by their wedge-point *(hilum)* into the sides of the outer ones. These mutually sheathing membranes besides are traversed both across and lengthways by a net-work of vascular canals, and consequently the fluid transmitted by each wedge-point must necessarily rise along the side next to the part above the wedge-point, falling down the opposite side, and again rising along the part below the wedge-point, or the contrary. At the same time a portion of the fluid is transmitted to the wedge-point of the next enclosed sheathing membrane, where the circulation will take a similar direction.

The flow of the sap from the cut ends of a plant may thus be explained; for on each cut surface there will be alternately one-half of a sheathing membrane, the fluid in which was rising up, and another half in which it was falling down.

The branches are always inserted by the wedge-points (*hila*) of their component sheathing membranes into the trunk or stem, and, consequently, the circulation of the fluid at the junction is the same as that just explained.

The sheathing membranes of the root, it must be remarked, do not terminate in the outer sheathing membrane or burso of the stem, but penetrate to one of the inner ones, and hence the rising sap, as yet not organized, is conveyed to an inner sheath.

The strong attractive power of the tips of the root fibres, through which alone the liquid food of plants is transmitted, may be seen when roots have been forced to grow between stones; for the tips will be found to adhere more or less firmly to the stones, while the other parts of the root are loose and free. In the same way particles of earth will generally be found adhering to the tips of the root-fibres, having been attracted by the suction or aspiration of the spongiole. (*Chimie Organique*, 811, &c.)

Changes in the Sap.—The preceding are the views of M. Raspail, which further researches may either confirm or refute. The following are a small portion of the interesting experiments and observations of M. Biot on the sap and its changes, and these, it may be remarked, wear more the air of fact, and look less theoretical, than Raspail's statements.

M. Biot first proposed to himself to ascertain by means of circular polarization, the presence of the gummy or saccharine principles in the sap of trees, and to trace these principles as connected with the nourishment of the young buds in spring. Some of the facts which he discovered were very remarkable.

He pierced with holes, sloping slightly downwards, several species of trees, early in February, —the almond, the birch, the hornbeam, the maple, the ash, the lilac, the mulberry, the walnut, the elm, the poplar, the plane, the willow, the elder, the sycamore, the lime, and the vine,—fitting into each hole a dry reed, with the inserted extremity cut sloping, and scarcely penetrating deeper than the bark. The other extremity entered a small phial, suspended by a bit of wire, and luted with a mixture of oil and wax, immiscible in water. The flowing sap was collected in these phials, and when any evaporation of the watery portion occurred, from the temperature of the tree being higher than the air, it was condensed within the phial. He was not contented with experimenting on one tree of a species, but selected several of the same sort in various positions and exposures; and he also fixed on the same tree a considerable number of phials, at various heights from the ground.

In the birch he both discovered that the sugar in the sap is not cane, but grape sugar, and also that the sap actually flows progressively from the root to the summit, the flow varying with exterior physical causes, which serve to modify it. The walnut, the sycamore, and the maple, did not in February show any flow of sap; and M. Biot took advantage of their state of rest to examine their interior by having a number of trees of these species cut down on purpose. It was remarkable that the interior of the birch trees were found to be without moisture, and even quite dry, while the walnut and sycamore trees were distinctly soaked (*imbibé*) with moisture, from the inner surface of the bark to near the central pith. On being pressed, also, the moisture could be squeezed out, and the oozing was most distinct between each of the circles constituting the annual rings of wood. All this was observed while there was no flow from the reeds into the phials except in the birch.

The walnut trees began to give a few drops about the 11th of February, in the phials placed about seven inches from the ground. The sap thus collected was not fermentable grape sugar, like that of the birch, but crystallizable cane sugar, for it gave a strong polarization towards the right, while that of the birch was towards the left. The run into this lower phial, after continuing abundant for several days, began to diminish towards the end of February, and at length it ceased altogether. The phial immediately above it, about a yard from the ground, also gave a very small quantity, while all the other phials on the same tree, to the number of eighteen, remained quite dry.

What appeared most singular, was, that this individual walnut tree was known to be rather a late one, while another very large one, at a hundred paces distant, known to be about fifteen days earlier, gave no trace of sap in fifteen phials which M. Biot had attached to it. He began, accord-

ingly, to suppose that this early walnut, as well as the sycamores and maples, had been pierced too late, and that the spring flow of their sap was over; or rather that, in the then state of the atmosphere, they evaporated as much sap as they received from their roots. The flow, of course, would not again take place unless the evaporation should be checked by the occurrence of cold weather. This actually did occur, the thermometer falling to one degree below zero, followed by a sharp dry frost, when the maple, sycamore, and walnut trees began to flow, continuing thus till the 16th of March, when the flow began to diminish. M. Biot says, the effect of the cold on the birch tree was very different, but gives no details.

M. Biot distinctly proved that the sap near the root is less dense, and less rich in saccharine matter, than higher up in the trunk or branches, a fact previously stated by Mr. T. A. Knight, but explained by him to arise from the sap in spring mingling with the condensed nutriment deposited in the roots the preceding autumn. M. Biot thinks differently, believing it to arise from the watery portion of the sap being, in its ascent, either diffused through the cellular substance, or evaporated, or both; and he proved, that, though the sap collected in the phials at different heights from the same tree was more dense and rich, the higher it was procured, the portions of wood and bark containing the sap gave exactly the same proportions of saccharine or nutritive matter, at all heights.

M. Biot farther discovered, that the swelling and opening buds (at least of the lilac) have the power of decomposing the sugar of the sap, and of appropriating the carbon contained in it, in the same way as he proved the seed-leaves of corn to decompose the fecula contained in the grain, and change its dextrine into the sugar which nourishes them.

Observations on the Growth and Nutrition of Corn.—M. Biot, finding that the slow growth of trees was not so well adapted to some of his experiments as the quick growth of annual plants, made choice of wheat and rye for observation. It has long been known to physiologists, that, in the process of germination, the farinaceous matter (now known to consist of globules of dextrine in their envelopes) is changed into sugar, which serves for the nourishment of the young plant, up to the period when its seed leaves and primary roots make their appearance. But when the supply of nourishment contained in the seed has been exhausted, the young plant must depend on other sources to maintain its growth; and hitherto it had not been experimentally determined what these other sources of nourishment really are, what modifications they undergo in the various parts of the plant, nor in what manner the different portions are transmitted to the nascent seed in the ear, to nourish and mature it.

It is important, in all such inquiries, to distinguish the solid parts, which constitute the framework of the plant, from juices or soluble materials, which, constantly formed, destroyed, and renewed, are carried into all the vegetable texture for its nourishment. The first, or solid materials, can be examined by chemical analysis after a plant is dead and dried; but it is different with the other parts or liquids examined by M. Biot.

Rye.—He made his first observations, the 3d of May, on plants of rye already in the ear, but not yet in bloom, the period of blooming being still at some distance. He treated the roots, the stems, and the ears, each separately, with water, submitting them to the proofs of circular polarization, and then he treated the watery extracts condensed, but not to dryness, with spirits of wine; submitting to the proofs of polarization the precipitates as well as the substances not precipitated from the liquids. In a word, he tried, by adding to each the yeast of beer, whether they were susceptible of fermentation, again examining whether their rotation was diminished, increased, or changed in direction.

The matter from the roots gave traces of an exceedingly feeble rotation towards the left; but when it was observed, M. Biot had not discovered that a mixture of cane and grape sugar would, in a manner, neutralize the right and left rotation. The stem indicated a proportion of grape sugar turning to the left, and of cane sugar turning to the right, as well as gum precipitated by spirits of wine, and turning to the left with a force similar to gum. Twelve days afterwards, the 15th of May, while the ear was still far from blooming, the stem presented a mixture of the three substances, but with a considerably larger proportion of cane sugar, proved by rotation towards the right before being fermented.

The matter from the ear on the 3d of May, and before blooming, gave very different results from the matter of the stem; for Mr. Biot could not detect in it any sugar, either grape or cane, but only sugar of starch, of which fermentation enfeebled the circular power, without changing its direction. The precipitates also formed by spirits of wine, instead of having the characters of gum as those of the stem, showed only flakes similar to the envelopes of dextrine in the mature grain. These results accord with the observations of M. Raspail, who ascertained that, before blooming, the grains of fecula in corn are extremely small, and that their soluble matter is gradually absorbed by the seed organ (*ovarium*), which it serves to nourish. M. Biot, as yet, found no dextrine.

After blooming, the composition of the ear was found to be very different. The 15th of June, the young grains of rye taken from the ear, already contained globules of fecula containing dextrine, along with some sugar of starch, but no trace of cane nor grape sugar. It follows, M. Biot infers, that the cane sugar, the grape sugar, and the gum, which are contained in the stem and leaves of rye, are changed in their nature on passing the neck of the ear (*le collet des épis*), supplying materials for nourishing the young grain, which forms it into dextrine and its envelopes.

Wheat.—In his observations on wheat, M. Biot was more particular than in the case of the rye to keep separate the different parts of the plant, and, in consequence, discovered differences of composition, which he could not have beforehand imagined.

The 19th of May, he took young plants of wheat whose ears had not issued from their sheath or hose, he carefully separated the sheathing leaves from the cylindrical stem, and treated the two separately with water, alcohol, and fermentation. The stems, like those of rye, presented three carbonaceous substances, namely, grape sugar, cane sugar, and gum; but subsequent observation showed, that the proportions of these three substances varied much during the progress of ve-

getation. The 20th of May, the cane sugar evidently predominated; but the 4th of June, when the ears began to bloom, the stems gave a rotation towards the left, and afterwards preserved this rotation, showing that the cane sugar had become much less abundant *in the stem.*

The leaves gave very different results; for though they contained three substances, the cane sugar was proportionably much greater than the grape sugar, the contrary of what was found in the stem; and instead of the third substance being gum turning to the left, it produced a rotation towards the right, appearing in fact to be dextrine. The leaves of wheat continue to preserve the same composition till they begin to grow yellow and wither, an effect that uniformly commences at the tip of a leaf, and on the leaf nearest the root; but after this, scarcely a trace of sugar or dextrine can be found in them, all, it would appear, having gradually passed into the stem to nourish the ear, in the same way as the carbonaceous materials of the leaves of trees descend under the layers of the inner bark and pulp wood (*alburnum*), to nourish the young cylinder of wood and bark, which, similar to a hollow stem of wheat, is annually formed, and moulds itself upon the old frame work of the wood.

In wheat, therefore, as well as in rye, the base of the stems can derive nourishment partly from the leaves and partly from the soil, and the summit of the stem can draw nourishment from its own leaves, as well as suck up the sap from below; but the ear, when it issues from the sheath, appears to exercise on the proper juices of the top of the plant a powerful absorption, causing them to rise rapidly in proportion as they are furnished by the base of the stem.

The 4th of June, M. Biot took plants of wheat in full bloom, and depriving the stems of their leaves, parted them into halves, the tops in one parcel and the bases in another. The extracts from the base, when examined by polarization, indicated almost twice as much sugar as the extracts of the tops of equal density; and at the same time he found, that the saccharine principles abounded in the ears of the wheat, in the form of cane sugar and sugar of starch, together with a substance similar to, if not identical with, dextrine.

Ripening of Corn, and Ploughing of Green Crops for Manure.—In proportion, it has just been shown, as the fecundated ear increases in magnitude, the leaves near the root begin to grow yellow and dry, in consequence of the stem drawing from them the carbonaceous materials which they contain. As the growth advances, the base of the stem becomes yellow and dry in its turn, while the upper part remains green, and continues to nourish the ear.

These beautiful researches of M. Biot, afford interesting explanations of several agricultural practices hitherto not well understood, at least in a scientific point of view. For example, when the base of the stem begins to become yellow and dry, if the corn be then cut down, though the grain is not ripe, it will continue to be nourished at the expense of the green matter in the upper part of the stem, almost, if not quite as well, as if it had remained uncut, and will thus ripen well; while, having been thus cut down early, much loss from shaking is prevented, besides the chance of loss by *lodging* from heavy rain and wind. M. Biot's experiments, from his well-known high character for rigid accuracy, are therefore well calculated to give farmers confidence in cutting down their corn, as soon as the lower leaves and the lower part of the stems are yellow and dry, though the upper parts be green.*

Again, as the leaves and stems of plants, while green, contain sugar and other carbonaceous materials for nourishing the seeds and bringing them to maturity, it follows that, if they are in this state ploughed down into the soil, they must greatly enrich it with all the products ready prepared for the nourishment of plants.

It has been proved, indeed, by other experiments previous to those of M. Biot, that the leaves and all the green parts of plants, decompose the carbonic acid gas of the air, appropriating the carbon and setting free the oxygen; and hence it has been inferred, that the carbon thus derived contributes to form their mass of sugar and gum, additional to the sap absorbed from the soil by their roots. This view is corroborated by the difference which M. Biot has shown between the composition of the leaves of wheat and the stem, which is more especially supplied from the soil. If, then, a portion of the solid frame-work of plants is derived from the air in the form of carbon, the ploughing down of green crops for the purpose of manure, gives to the soil more than the plants, while growing, had extracted from it.

We may well conclude with M. Biot, that "every positive determination in science is susceptible of progress and of useful application, though these may be distant. A microscopical observation, or an optical property, which at first appears only curious and abstract, may thus in time become important to agriculturists and manufacturers."

BAKING BREAD BY STEAM.

About twelve months ago we inserted a paragraph, stating that a machine had been invented in America, which could manufacture a ton weight of flour biscuits in an hour. This gave rise to much conversation at the time; and we must confess we

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* It is a good practice to cut down every kind of grain before it is fully ripe in the grain or the straw, and that for the reasons just enumerated in the text. But, as M. Biot's observations and common practice do not exactly agree as to the symptoms which determine the time of cutting, it is as well to notice the difference. In a *fine season*, farmers cut down when they find the neck of the straw, immediately under the ear, free of juice, when twisted round between the finger and thumb; and do not wait until "the lower part of the stems are yellow and dry," because they find in such a season the straw *to die from the ear downwards*. This fact, we conceive, does not militate against M. Biot's *theory*, for as the absorbing power of the ear at the top of the stem is always powerful, it must be the more powerful the nearer the ear approaches maturity, and of course, the part of the stem nearest the ear should first become dry. In a bad season, on the other hand, the lower part of the stem first becomes yellow and dry, after which, of course, the crop is not allowed to stand; for, in such a season, the ear never becomes mature, having, of course, less absorptive power, whilst the vitality of the root is early destroyed by the combined effects of bad weather and ungenial state of the soil.—EDITOR.

were ourselves, though somewhat fond of the marvellous in mechanical powers, amongst those who doubted the authenticity of the statement. This paragraph, however, was not without its effect. Amongst others it caught the eye of Mr. Dodgson Carr, of this city, who being a practical man, determined to inquire into the real facts of the case. He soon found that the statement was true in all its parts, and, like a sensible man, he determined to profit by his knowledge. A machine was ordered; and in a very short time large and commodious premises were erected in Caldewgate; and in that once neglected part of our city there is now actually at work a machine fully capable of performing the wonders ascribed to it in our paragraph. We had the curiosity to visit the place the other day, and must confess that, on seeing the machine, all our doubts vanished. It is fully capable of doing the work named, and the ingenuity of the invention is no less striking than its cleanliness, neatness and portability. The dough or paste is kneaded by machinery, rolled by machinery, and cut into form by machinery; and by and by it will be baked by the same steam which carries that machinery.—*Carlisle Journal.*

From the Mark Lane Express.

PLANTING POTATOES.

Sir—You have below the general result of a crop of potatoes planted in April last year, with a view to ascertain what difference, if any, might occur—1st, where the potato was planted *whole*, except the crown; 2d, where planted *whole* with *one* eye *only*.

Soil, sandy loam; within a very few years past, furze-land. Previous crop, wheat, stubble turned in late in the autumn, manure from the yard, chiefly cow dung; a tolerably good dressing, ploughed in. nine bouts to the rod; sort, *Kentish kidney*, dibbled with a large blunt dibble *upon* every other plit, and *well* covered.

Forty-five rods planted with a view to the first, and other forty-five rods with a view to the second question. The distance in the rows, about fifteen inches; depth of holes, full six inches. The roller was passed over after planting, and then harrowed with a hand-harrow; edge-hoed once, and earthed up once by the common one-horse break.

During the growth of the haulm, appearances were much in favor of number 2; and, as to *weight*, when taken up, it retained its superiority over number 1, by a yield of full one quarter more; but the potato was knobby, large, irregular, and ungain; number 1, very uniform in shape, somewhat exceeding in size *ordinary* ware; a good table potato.

The general produce, when taken up late in November, not to be complained of, and boiling remarkably mealy, if properly boiled.

Doubtless such experiments have been often made, and a better or more detailed account of them has as often been given, but such as mine were, you are heartily welcome to make public through your useful paper. You are the best judge of their worth, whether to insert them or not.

I am, respectfully your's,

Thos. Lee.

Bexley Heath, Feb. 1, 1837.

P. S.—Were the experiment to be repeated, the distances, both as to plit and in the rows, might, I think, most usefully be enlarged. I may just observe, that some of my neighbors, who had planted *sets* or cuttings, had very indifferent crops.

From the American Journal of Science and Arts.

ROTTING OF TIMBER IN CERTAIN SITUATIONS.

Extract of a letter to the editor, from Mr. D. Tomlinson, of Schenectady, N. Y., dated April 4, 1836.

In the year 1810, I built a ware-house on my lot in Union Street, in Schenectady. The cellar was dug about four feet deep, and the stone wall a foot or two deeper. I left no opening in the walls for door or window. The floor beams were of excellent pitch pine timber, of twelve by twelve inches, slit, and were six by twelve inches when placed in the wall, and about eighteen inches above the ground. I laid a floor of three inch oak plank, loose, neither jointed nor nailed, although they were square edge, and lay close to each other. Five years thereafter, I observed a jostling in a place in the floor, and raised one of the planks to learn the cause, and found one of the six by twelve inch beams rotted off and fallen on the bottom of the cellar. The plank was rotten below, except about an inch sound on the upper side. I lifted the whole floor, found most of the planks rotten, except a shell on the top; and the timbers were rotten, and so decayed, that I took them out and put in oak, after making windows and a door in opposite sides of the wall. I thought the depth of the cellar would have prevented injury to the timber, but found it the cause of the destruction, as fine shavings and slivers lying on the bottom of the cellar, were perfectly sound, while the timbers, were beautifully ornamented with curtains of white mould, hanging in festoons, nearly to the depth of the cellar, as white as snow, very thick, and appeared like bleached muslin.

In the year 1817, I took down an old kitchen on the same lot. The floor had lain on saplings of about 6 by 8 inches, such as are used for scaffold poles. They were bedded in the ground, so that the pine floor came next the ground, and excluded air. They had lain there from 1794, and both the timbers and flooring were very little injured by rot.

I concluded, that a free circulation of air must be allowed, or air must be entirely excluded, to save timber from decay.

It has been found, that when posts are set in the ground and cased with boards, for better appearance, the confined air destroys them. Even red cedar, which lasts an age when set open, if cased, which is often done for ornament in gate posts, decays as soon as any other wood, by the confined air.

From the Records of the United Agricultural Societies of Virginia.

ON CLOVER FALLOW FOR WHEAT.

[The following letter was written at a time when the clover husbandry was considered altogether impracticable for the poor lands of lower Virginia. *Now,*

when it has been established that calcareous manures will remove that natural defect of those soils, this letter may be far more serviceable for that region than when it was written, or than its writer could then have anticipated. Ed. Far. Reg.]

Bremo, Fluvanna, 21st December, 1830.

Dear Sir,

Yours of the 2d December, did not reach me until within a few days, from the circumstance of its not being sent to my usual post office. This will excuse me for not being more prompt in my answer to you. The consciousness that you have counted too largely upon the information I am able to impart, on the various agricultural subjects referred to in your letter, and the anxious desire I feel to encourage the spirit of inquiry, which seems to be spreading itself amongst the cultivators of every section of the state, induce me, the more readily, to comply with your wishes, as well to evince my perfect willingness to contribute what I can in so good a cause, as to apprise you promptly of the necessity of your applying to other and better sources, for the desired information.

Your queries shall be taken in the order in which they are made, and without confining myself to the direct answers, shall add such general remarks as appear to me any way connected with rural economy.

1. "The process of fallowing as practised by myself." This is to plough in a crop of clover, as nearly as possible at that stage of its growth, when it is in the best state for cutting to make hay. Of course, where there is a full portion of your rotation in clover, there can be but a part of your fallows ploughed exactly in the proper time, without extra teams, and unusual seasons. Hence, the necessity of beginning a little before the clover has attained the precise point, to yield the greatest advantage from being turned into the earth—and hence too, the necessity of a second ploughing, where your first was early, and the season favorable to vegetation after the process. But I deem it less important to be minute upon this head, as for reasons hereafter to be assigned, I do not think summer fallows and the clover husbandry (which I consider as inseparable,) suited to the sandy soils of the lower part of this state.

2. "The advantages as to product of a clover fallow over wheat after corn?" This may be stated to vary from nothing to a double crop, depending upon the opportuneness and perfection of the process, and the adaptation of the land to the use of plaster of paris. Soils suited to plaster, with a heavy crop of clover ploughed in, at the proper time, previously dressed with three or four pecks of gypsum to the acre, followed by favorable seasons for rotting the buried clover, and seeded in the month of October, will rarely fail to give two bushels, for one from the same land after Indian corn. On the other hand, a crop of clover (and the heavier the worse for it,) dried by our powerful sun, and consequently imperfectly buried, from the hard and unmanageable state, into which the earth is brought frequently by the summer droughts, will often not yield a better crop than the same land would produce after corn.

3. "The difference in the quantum of labor in fallowing for wheat, and wheat after corn." This can only be decided by referring to the number and kind of operations which are performed in each process, and as these ought to depend, in number and kind, upon a variety of circumstances, the relative expense of the two modes of husbandry must necessarily vary in like manner. Under a fortunate concurrence of circumstances, fallows may be seeded upon the first ploughing, and completed with a single harrowing; but it often happens, that a second ploughing, and under particular circumstances a third, and two harrowings, may be necessary to do justice to the crop. In like manner, a single operation, with a single horse plough, and a slight chopping the step, will frequently do more ample justice to the wheat crop after corn, than, under other circumstances, will result from cutting up your corn, breaking up with the double plough, harrowing to receive the seed, and sometimes ploughing with single ploughs before the second and last harrowing.

4. "The effects as to improvement and exhaustion." These are also much influenced by the circumstances already adverted to as affecting the production, but it may be assumed, that the land is left in much better heart after a fallow crop, than after wheat succeeding corn; when the last, however, has credit by the greater quantity of grain yielded by the two crops over the one, it exhibits too imposing a claim, upon the score of profit, to be given up, even on our clay lands. On the light sandy lands of the lower country, so much better suited to Indian corn, and less adapted to fallows, I am of the opinion, that wheat after corn, is the most profitable and judicious course of husbandry.

5. "On what soils is the practice of fallows most beneficial?" Wheat soils, or those having a considerable proportion of clay in them. This being the soil, only upon which clover can be profitably and extensively cultivated, I would recommend summer fallows only, where this description of soil was found, and the clover husbandry practised. Upon this kind of land, without clover, I should not hesitate to adopt winter fallows; in other words, the English naked fallows, stirring them with single ploughs through the summer, in preference to depending on a late summer fallow. The influence of the sun on this description of soil, recently exposed, is not as injurious as on sandy soils, and by no means equal to the evils arising from the hard and untillable state into which our summer sun bakes it.

The remarks on this head sufficiently express my opinion, as to "the profitable introduction of fallows where a reduced sandy soil and hot sun preclude clover."

6. "What is the difference of product between wheat after one ploughing on grazed land, and that not grazed, or is either practised." Both are practised, and when the vegetable matter is turned into the earth, in a favorable state for rotting, that is, with some remaining succulence, and succeeded by a suitable season to promote putrefaction, the great agents of which are moisture and heat, the more that has been turned in, the better the succeeding crop, and the less the injury sustained from its maturation. But in the two last dry summers, I have known some fields of fallowed wheat almost destroyed by the dry vegetable matter remaining undecomposed in the soil. It seems, therefore, to follow, that the less vegetable matter turned into the soil, the better for the immediate crop, unless it is prepared by decomposition into the food of vegetable life.

7. As to "the period that land may remain under grass, for improvement, before fallowing without causing the crop to be foul"—there is a difference of opinion among the farmers of this quarter, but I think there is a preponderance in favor of the opinion, that clover, (we cultivate no other grass,) ought to be ploughed the summer twelve months after sowing it, and of course where it is cut at all, the same year of taking off the crop.

My own practice has been to plough in clover the summer two years after sowing it, thinking it reasonable that the land would be more improved by its longer rest, and giving the whole growth of the year it is ploughed to the soil; but the result, especially for the two last years, has disappointed me. It may be objected to my practice generally, too, that the earth becomes much more firmly settled, and is brought into tilth with greater difficulty. On the other hand, it may be said, there can be but little more than the mere roots counted upon for the improvement of the soil, where the first crop is taken for hay, and the second for seed; and this, too, necessarily limits you to the latest period for the performance of your ploughing for the fallow crop, thereby diminishing the chance for a timely preparation. Where clover is sown merely for the improvement of the land, and not intended to be cut at all, there is little doubt that the best time for ploughing it in, would be the summer twelve months after sowing it; but that seems to be an objectionable clover system, on more accounts than one, which affords neither hay or seed. The other practice, of cutting hay and ploughing the same year, has been practised by the best farmers on this river, and as they are more experienced, and have been more successful than myself, I cannot in justice but recommend their practice, in preference to my theory.

8. "What depth of ploughing is necessary where the soil does not exceed three or four inches?" As far as my experience has gone, the depth of ploughing should in all cases depend upon the character of the subsoil. Light soils, based on steril sand, I would plough no deeper than the vegetable mould; but where clay is the foundation, and especially of that description which is fertilized by exposure to the atmosphere, I would bring up the largest possible proportion of it, that would leave the soil in undiminished productiveness by the mixture; nay, I should be inclined to increase the proportion to a small diminution of its immediate productiveness, for the sake of the great future amelioration. Upon all good wheat soils, the ploughing should be as deep as three horses can perform with the best constructed plough. I am sure I know of no upland soil, that would not be rendered entirely unproductive, for at least one year, by being ploughed eighteen inches, or two feet; for although some of our clays become fertile, by exposure to the atmosphere, it requires the operation of at least one winter, for any sensible effect to be produced. It is, however, stated, that the celebrated Fellemburg, whose scientific and agricultural establishment, at Hofwyl, has attracted so much attention throughout Europe, has ploughed two feet deep, with an implement requiring the power of fourteen horses. During my residence in the lower country, and in the course of my experiments on the sandy soils of that section of the state, I am satisfied that I did great and lasting injury to some land by ploughing it about six inches deep. This land was on a poor sandy foundation.

Having gotten through your queries, I will add, as succinctly as possible, my thoughts on a plan of husbandry, suited to the light sandy lands of the lower parts of the state. I should adopt a system excluding clover, because from the nature of your soil, and the generally reduced state of the land, the attempt at the field culture, upon a large scale, would be attended with no other result but the loss of your seed; and as summer fallows should only be practised as the concomitant of clover, those likewise I should consider as out of the scheme.

Assuming it as the basis of all good husbandry, that for every exhausting crop, there ought to be some counteracting improvement, I would cultivate no more land in corn than I could manure. This I think can be effected under a six-field rotation, which would reduce the quantity to be manured to one-sixth of the arable surface, and the succession of crops should be, first, corn; second, wheat; third, pasture; fourth, peas, and all leguminous crops; cotton, pumpkins, and potatoes, might occupy a corner of this field; five, wheat; six, pasture.

The first, and most ostensible objection to this scheme, is, the apparent small proportion of corn, not insuring a sufficiency of that necessary crop; and secondly, the difficulty of raising the required quantity of manure. In answer, it may be said, that in the best cultivated counties of England, we are told, they manure as much as one fourth of the arable surface yearly. It is true, that some part of this manure is derived from other resources than those of the farm; to wit, their towns, manufactories, and marl pits; but the improvement derived from all these sources, I presume, does not amount to the difference between one sixth and one quarter. Besides, all the tide water districts of Virginia abound in marl, so that, in this respect, you, in all probability, stand on an equal footing with the English farmers—and if all that labor, which is now bestowed on clearing land, and renewing our quick-decaying fences, and other perishable improvements, which ought to be substituted by more permanent ones, were directed judiciously to the accumulation of the materials of fertility; digging marl, collecting rich earth from bottoms and swamps, those depots of nature, which are constantly by the operation of natural causes swallowing up the primest principles of fertility, to be added to the materials common to every farm; I am persuaded, we should find there would be less labor in collecting the means of fertilizing an acre, than in preparing it, from the forest state, and inclosing it for a crop.

An accurate statement in detail of the relative expense of manuring an acre of land, and bringing one from the forest state into cultivation, is a desideratum as much called for in Virginia husbandry, as any that has ever occurred to my mind. If I am not much mistaken, it would prove, that less labor would be required to improve the lands throughout Virginia, than it has taken to reduce them to their present deteriorated state.

As to the objection that one sixth part would be an insufficient portion of the arable land to have in corn, it may be replied, that that portion, manured at the rate of 20 or 25 loads, of 30 bushels each to the acre, would, on ordinary land, produce a double crop—and, therefore, would not only be equal

to one-third, the proportion now usually put in corn, but would produce the clear saving of one-half of the labor of cultivation, besides other almost incalculable advantages.

Upon your sandy soils, I think you might reduce the quantity of manure four or five loads to the acre, below what is necessary to produce the same result on the clay lands of the upper country; for light lands make a much better return, for a small quantity of manure, than stiff lands. I have increased the corn crop 100 per cent. upon the ordinary high lands here, with 25 loads of 30 bushels each to the acre, which in their natural state would produce about two barrels. I am confident equal effects would be produced from 20 loads, upon the light soils of Prince George and Surry.

Where wheat is relied upon as the chief crop for market, as is contemplated in the foregoing scheme, the materials for manure would be very much increased—and, the frequent recurrence of pasturage would be more than overbalanced by the additional comforts in living, and the profits to be derived from stock, which, with your facilities of communication with the best markets, ought to be no inconsiderable item in your annual income.

The field in peas, &c. would more than compensate for any contingent deficiency in the corn crop, leave something for market, and from the highly meliorating character of its crop, would be in a better state of preparation for wheat than any grass crop turned in, on sandy lands, that I know of. The offal of the products of this field, would contribute largely to the general fund of manure. And, until a system is devised to increase this fund to an adequate supply, for that field in the rotation which is in the most exhausting of all our crops, Indian corn, regular deterioration must be the consequence of our tillage. It is in vain to amuse ourselves with expedients; practical agriculturists will soon all agree that nothing short of a full manuring once in the rotation, will insure general and permanent improvement.

Accept the assurance of my high regard and esteem.

JOHN H. COCKE.

To EDMUND RUFFIN, Esq.

From the Carlisle Patriot.

FLY IN TURNIPS.

Dalston, May 8.

Sir—As the season is fast approaching for sowing turnips, I beg to offer the following receipt, as an effectual protection from the ravages of the fly, or black grub, which I have proved by frequent trial. I will feel happy if any of the farmers will call upon me this summer, when I hope to prove to them the efficacy of my receipt. Your obedient servant.

JOHN BIRKETT.

To a quart of turnip seed add one ounce of brimstone finely powdered, putting both into a bottle large enough to afford room to shake them well together, for four or five days previous to sowing; keep the bottle well corked.

QUERCITRON BARK.

In answer to the inquiry of a correspondent from Kentucky, of the editor of Bicknell's Reporter, of Philadelphia, as to what species of oak this bark is obtained from, how it is prepared, what use is made of it, &c., it is stated that quercitron is the black oak bark; that it is prepared by shaving off the outer bark, grinding the inner bark, drying, and packing it in hogsheads. It is used almost exclusively for dyeing, and is sold largely in Philadelphia and N. York, at from $30 to $40 per ton of 2240 lbs. It is packed in casks larger than a whiskey hogshead, each of which contains about 15 cwt. The distinction in quality consists in its degree of clearness and brightness of color. It is inspected before sale. Dr. Bancroft first discovered the useful properties of this bark, and obtained a patent for his invention in the year 1775.—*Jour. of Amer. Institute.*

THE GREEN CROP SYSTEM.

From the "Agricultural Papers" of Agricola, in the Downpatrick Recorder.

"The farmer's life displays in every part,
A moral lesson to the sensual heart."

BLOOMFILD.

To prevent a long digression in my last paper, I was obliged to assume that, though there are some crops which impoverish the soil very much, there are others "which are more grateful to it, and which instead of impoverishing it, afford a reciprocal advantage, by imparting to it richness." But as this statement contains the fundamental principle of the important system which I am advocating, it should not be taken on trust; and, accordingly, the object of my present paper is to show, that the green crop system is not founded on a false assumption, but on an *important truth.*—The whole crops of the farmer may be divided into two classes—the grain crops and the green crops. The former are sometimes called *culmiferous* or straw-bearing; and the latter, *leguminous*, from their seeds or leaves being of a much larger kind. Clover, beans, turnips, potatoes, &c., are leguminous plants, or belong to the class called green crops. Now, it has been proved, by experiments made for the express purpose of ascertaining, and is, therefore, beyond a doubt, that plants are not nourished by the soil alone in which they grow, but that much of their sustenance is drawn from the atmosphere; of course, they do not derive the same degree of support from either of these causes—some are nourished more by the earth, and others more by the air. Grain crops are of the former kind. As they have but small leaves, and few of them, and thus present but a small surface to the action of the atmosphere, it is plain that little of their nourishment can be derived from it: they must, therefore, be supported almost entirely by the soil. This is particularly the case when the crops have nearly ripened, when the few leaves they have are withered and dead, or have fallen off; they can then draw, perhaps, no nourishment from the air, but must be supported almost entirely by the soil. But the fact is not so extensively known as it deserves to be, that, at this period, when the seed is forming, the plants require an extraordinary quantity of nourishment; and hence it is that grain crops are so particularly exhausting to the soil. In proof of this, I may refer, with confidence, to the experience of any intelligent practical farmer. He knows, that if the grain be allowed to stand uncut

after it has ripened, it exhausts the soil exceedingly; but, that if cut green, the impoverishing effects have not been so extensively produced. Now the green crops or leguminous plants, on the contrary, present an extensive surface to the action of the atmosphere, and, therefore, can draw much of their nourishment from it, without requiring to draw so extensively from the soil. A familiar proof of this may be had from the common cabbage. Its numerous broad leaves enable it to draw most of all its nourishment from the atmosphere, and hence it is that cabbages can be preserved for a long time in a fresh state, if cut and hung up in a damp place. House-leek is another plant which has broad succulent leaves; and who does not know that it will grow in the most unfavorable situations?—If hoisted on a pole, or laid on a slab of marble, it will flourish most luxuriantly. But this is not all; some plants have been proved to exist, and thrive, and come to maturity, when nourished by the atmosphere alone—growing in pounded quartz, (a substance resembling flint) and supplied with distilled water, to prevent the presence of the smallest particle of earthy matter! Another important fact is, that all the seed of a grain crop comes forward at the same time. Whenever it has properly "shot," the plant stops growing—its seeds begin to form, its leaves wither, its roots cease to act in the ground, and, when cut down, it is dry and hard. The green crops, on the contrary, bear blossoms and seed at the same time; the roots are continually pushing forward in the ground, and the leaves are green and sappy as before, so that the plant never exerts itself to impoverish the soil. Every one knows, for example, that beans and peas may be pulled from the lower part of the stalk, while the top is bearing blossoms and embryo fruit; that one branch of a stalk of clover will be in flower and another in seed; and that the top of a potato stalk will wave in verdure and bloom, when the crabs and leaves have fallen off the lower part. It may not be out of place to mention here a serious error in which many farmers fall. They allow their rye-grass to remain uncut long after it has come to maturity, alleging as a reason, that "unless it is 'dead ripe,' it will never do for seed." They forget that it is cultivated chiefly for the hay, and not for the seed; and that by allowing it to become ripe, they are disappointed of their object, as much of the seed is lost in the necessary operation of saving the hay. Besides, the quantity or weight of the hay is diminished by the parching and withering it has undergone; its quality is deteriorated, as it is rendered less palatable and less nutritious to cattle; and the fertility of the soil is greatly injured. To prevent these consequences, a small spot should be kept to furnish seed, but all the rest should certainly be cut green; the pasture produced as an aftergrowth would of itself be a sufficient remuneration for the loss of seed. A remarkable difference between the grain crops and green crops, is, that the former tend to bind the ground and harden it, the latter to open and pulverize it. This is partly to be accounted for from the difference of their roots. Those of the one kind being numerous and fibrous, unite the different parts of the soil firmly together, without being large enough to produce such an action as would loosen it; those of the other kind being larger, and more of an opening nature, cause an action in the soil, during the process of growing, that reduces it to a soft and mouldy state. Another cause is the difference of their fitness to to admit moisture. When dew or rain falls upon a grain crop, nearly ripe, it glides down its hard, dry, bare stalk, and settles on the ground; but as this presents a hard-bound surface, it remains there until the greater part of it is carried off again by the heat of the sun. When it falls on a green crop, it receives a shelter under the broad leaves, and, trickling down the stalk to a soil softened and prepared to receive it, it contributes to moisten it, and render it softer. Of all grain crops, wheat is by far the most severe upon the soil. It is, in the first place, exceedingly binding, and always leaves the ground in a hard state. Then it occupies the ground so long, that it requires an extraordinary degree of nourishment, from its sowing till its reaping; the weight of the grain, besides, requires a strong stalk, and much earthy matter to bring it to perfection. Of green crops, again, potatoes are the most loosening. They sink deep into the soil, and by the spreading of their roots in every direction, and the swelling of numerous bulbs, loosen it most effectually. It is said that a crop of potatoes is more effectual, in this respect, than a good ploughing would be. One thing, however, is certain, that no matter what may be the color of the soil when the potatoes are planted, when they are turned up, their beneficial effects are apparent; for the soil is uniformly of a rich blackish color. If I were asked, which of the various kinds of potatoes is most pulverizing and beneficial to the soil? I should answer—notwithstanding the foolish prejudices which prevail respecting them—the "cups," or "west reds." Besides sinking much deeper into the soil, they are more numerous than other kinds, and, therefore, give it a more thorough turning up. Now, from these facts, what inference can we draw? That a wheat crop should be preceded by the most loosening and fertilizing crop that can be had, viz. potatoes. They clean the ground, and, as is evident from the parallel I have drawn, they put it in a state of complete preparation for the wheat. It is absurd, then, to expect that as good crops of wheat will be produced on fallow ground, on which there have been no potatoes. Another conclusion, which is almost self-evident from the facts I have stated, is, that a green crop should succeed wheat, to compensate for the injury which the ground has sustained. This shows how utterly ruinous and unreasonable is the practice of taking several oat crops off the ground, immediately after wheat. Instead of nursing the soil, already too much exhausted, the very vitals are torn from it, and then, forsooth, it is permitted to "rest itself," until the omnipotence of idleness has completely restored it! Turnips are very good for the soil, but certainly not as good as potatoes. They derive, perhaps, more of their nourishment from the atmosphere, but their roots do not penetrate so far into the ground to loosen it. They are besides too late of being raised, to admit of being followed by a wheat crop; but they can be advantageously followed up by barley, which also suits a clean dry soil. Clover, too, is particularly fertilizing to the soil in which it is produced. Its lower leaves becoming withered, fall off, and rot about its roots, and thus produce a valuable manure—decayed vegetable matter. Its slimy succulent nature keeps the ground always in a state of fertility, and its numerous dense leaves

are particularly adapted for retaining the moisture that has been deposited by rains and dews. Who has not observed the rich unctuous appearance of ground where clover has been cut shortly after the deposition of the moisture?—I hope, and believe, that I have now proved my assertion, to the satisfaction of all who may honor this paper with their perusal. Let it be remembered too, that, in referring to the reciprocal advantages which arise from a proper rotation of crops, I have not once alluded to manures. If proper changes from grain crops to green crops, and *vice versa*, would almost of themselves, suffice to keep the land "in heart," what might we not expect, when, in addition to this, one fourth of it would be well manured annually? This part of the subject brings me now to the important question already noticed.—How is the manure to be produced?

AGRICOLA.

March 29.

THE IRISH OR GIANT IVY.

To the Editor of the Farmers' Register.

You will pardon me for suggesting to you that I gather, from reading your description of the ivy at Shirley, [p. 186, vol. v.,] that it is not the English, but the Irish or giant ivy, (*hedera vegeta.*) This is a vastly superior variety, compared to the common or English, (*hedera helix,*) of a less shrubby nature, grows with much more luxuriance, and presents a far more striking and beautiful foliage, just such as you have described. This noble climber, in almost every situation suited to its growth and full developement—whether mantling the artificial ruin or rockwork of flower garden or pleasure ground, or shrouding with a mass of the most beautiful foliage the immense masses of ruins of abbeys, cathedrals, monasteries, and the battlemented walls and turrets of baronial castles of feudal origin, which are scattered over Great Britain and portions of continental Europe—is imposingly beautiful, forming a striking contrast to the rude ruins which it often covers, and adding much to the beauties of surrounding scenery, and greatly heightening the interest with which the spectator contemplates these monuments of by-gone ages. But, though highly beautiful and ornamental at all times in such situations, it is, in my opinion, doubly so when viewed as a moonlight scene. In the lone hour when all is hushed and still, the borrowed and subdued light of the queen of night, renders it at once a striking and imposing object; and if there is a gentle breeze stirring its leaves and branches and sighing sadly, yet sweetly, through the ivy-latticed windows and crevices of these ruins, echoed from different parts of the mouldering edifice, with an astonishingly distinct and whispering sound, it requires no great stretch of the imagination of the intruder into these long-deserted halls, to fancy that it is the whispering of the spirits of by-gone centuries, who, at the still hour of night, revisit the once familiar scenes of their mortal existence, and remarking among themselves in audible, but to mortal ears unintelligible whispers, the change which all-corroding time has wrought on their once much esteemed possessions—themselves how changed but now unchanging—unconsciously he treads with a light and cautious step, fearful lest he should disturb or break the indescribably enchanting charm, which exists around him. Many such an hour have I spent amid such scenes, and I do not think that any other scene is so capable of imparting a soothing delight, or of subduing every unholy passion within the human breast.

Ruins of this description, from the many associations connected with them, can hardly ever fail deeply to interest the spectator; but, when covered with ivy, their time-worn appearance is softened, if not concealed. Nature, as it were, thus kindly concealing from our view, with a beautiful covering, the dilapidations and inevitable decay which overtakes and levels to the earth the proudest structures raised by men; and the wind, which moans through naked ruins with a rather unpleasing sound and effect on the listener, is, by its action on the ivy leaves and covered windows, softened into a music, whose plaintive cadence is soothing and delightfully pleasing. To those familiar with such scenes, the sight, or even mention of the Irish ivy, is always interesting; and the reading of your account of it, as seen at Shirley, brought up to my recollection, with striking vividness, the pleasing hours which I have spent under its massive foliage.

Though all of the ivy family are beautiful on ruins, or even on large and decaying trees, they are, from the great quantity of moisture which their foliage retains, injurious to the thin walls of modern edifices. I once witnessed the removal of a magnificent plant of the Irish ivy from the front of a mansion house, where it had been planted 20 years previous, and which, for this reason, it was necessary to remove. On taking it down, it was found to have penetrated in many places a solid wall of stone masonry upwards of three feet thick, and also to have penetrated a joint of the wainscot of a staircase about ten feet from the wall.

REMARKS ON MR. GAY'S LETTER.

To the Editor of the Farmers' Register.

July 9th, 1836.

It is with regret that I find from Mr. Gay's communication, in the last Register, that my remarks in the preceding number, on the communication of "R. D. K.," (in the concluding number of the last vol.,) relative to his (Mr. Gay's) practice as a farmer, should have been by him considered as being "made more in the spirit of ridicule, than from a desire to acquire information." Nothing could possibly be farther from my motives. Who "R. D. K." is, I do not know; and, I believe that you, at least, will credit me when I state, that with Mr. Gay I am also entirely unacquainted, either personally or by report, beyond the communication referred to, nor do I know more of Goochland, from personal observation, than I do of Liberia; hence, there could be no personal motive on my part, which could, were I even inclined, induce me to throw the slightest shade of ridicule on the practice of Mr. Gay, and I trust that the above explanation will satisfy him that my object was not ridicule, but a desire for information, and to see the statements of "R. D. K." supported by practical results.

I thank Mr. Gay for the frankness with which he has detailed some of his modes of cultivating corn, &c., and if I am not convinced of the general superiority of rakes over hoes, they at least may on some soils be as beneficial, and more convenient.

From what practical experience I have had of the drag-log and roller, I can attest to their usefulness on some soils, but do not consider them indispensable, or at all useful on many others, unless as a preparation for grasses, or drill crops.

To Mr. Gay's wish to know who I am, and to become better acquainted with me, I beg to say that it is not my present wish to appear in the Register other than anonymously. Under any other medium of becoming acquainted, I should be very glad to follow up the advance which he has made. I will only state, that I am also a practical farmer, and an overseer, and as such, cheerfully offer to him the right hand of a fellow laborer, though I have been bred to my profession by hard-working practice, in a school, and on a little spot of earth, where agriculture, either as a science or practical pursuit, is generally admitted to be well understood, and have subsequently had a considerable share of managing experience; yet my experience as a Virginia corn-planter, is limited, and though some of my notions may possibly differ from some of my neighbors on some points, I must, for this reason alone, decline complying, at least for the present, with Mr. Gay's wish to know my mode of preparing land; merely stating that crops under my care have been from five bushels of corn to the acre, through the field, to upwards of ten on particular spots.

N. L.

ON THE FILTH OF TOWNS, AND THE REMEDIES PROPOSED.

To the Editor of the Farmers' Register.

I read with great interest the articles in your last number (for June,) concerning the sanitary police of cities and towns. Having resided in one of these for twenty years, I am able, by my own experience, to attest the truth of the facts you have stated, with regard to the influence of uncleanliness on our comfort. The opinions you have expressed as to its effects on our health, ought, I should think, to commend themselves at once to the reason of every unprejudiced and intelligent mind. The remedy, so far as it seems to convert a nuisance into the means of fertilizing our soil, and supplying us with food, seems to be worthy of all praise. As to its details, I have formed no opinion. Possibly there may be some fastidious persons who may find it offensive to their imaginations to think of eating food produced from land thus manured. Perhaps the squeamishness of some might be removed, by recollecting the habits of swine, which we all know feed on these articles. Yet, I suppose, no one relishes our Virginia hams, or middlings, or joles, the less on this account. The truth is, that, by the process of digestion and assimilation, the food of the swine is so entirely changed, that the flavor of its flesh is not at all affected by his use of the articles in question. Now, if they were used as manure, they would not only undergo a similar change, effected by the organs of the vegetable, whilst it was growing; but the chemical changes wrought even before they had become its food, by their decomposition and the new combinations of their elements, would render them entirely different, when they were taken up into the circulation of the plant, from what they had once been.

With regard to the effects on health of the decomposition of animal substances, (whether those referred to, or the carcasses of beasts,) and the diffusion through the atmospheric air of the gases evolved, (even when they are not sufficiently concentrated perceptibly to affect the senses,) allow me to refer you to the opinions now universally received, of the fatal consequences of burying the dead, in large cities, and especially in churches. I do not pretend to have formed a judgment on the details of the plans you have proposed. Probably they need to be patiently examined and fully discussed, and may perhaps require to be much modified. Yet that it is important to adopt *some such* plans as you have suggested, I do not doubt. Let me remind you, however, that such changes are rarely made at once. Probably it is well that it is so. Beings of faculties so limited as ours, if they were instantly to adopt every real improvement, must do it at the expense of adopting with equal readiness every specious innovation. Persevere, then, in your efforts to enlighten and to rouse the public mind on this subject, and I doubt not, if your views shall appear on full examination to be as sound, as they certainly are plausible, they will ultimately and universally prevail.

URBANUS.

THE DIFFERENCE BETWEEN USING BRICKS IN THE DRY OR WET STATE, FOR MASONRY.

Proprietors who are about to have brick buildings erected, will do well to attend to the following statement—the purport of which is almost universally neglected, even by the few persons who are fully aware of its importance.

"Few people, except builders, are aware of the advantage of wetting bricks before laying them. A wall 12 inches thick, built up of good mortar, with bricks well soaked, is stronger in every respect, than one 16 inches thick, built up dry. The reason of this is, that if the bricks are saturated with water, they will not abstract from the mortar the moisture which is necessary to its crystallization; and, on the contrary, they will unite chemically with the mortar, and become almost as solid as a rock. On the other hand, if the bricks are put up dry, they immediately take all the moisture from the mortar, and leave it too dry to harden, and the consequence is, that when a building of this description is taken down, or tumbles down of its own accord, the mortar falls from it like so much sand."

Masons or bricklayers are sufficiently well informed on this subject; but it would seem that they care very little about the durability of their work—and there is at least one reason why they are very unwilling to use bricks in a proper state. Bricks, to be saturated, will absorb so great a quantity of water, that their weight becomes greatly increased, and consequently, the labor of handling and laying them. And unless proprietors were willing to make a considerable addition to the price paid for laying dry bricks, the workmen would be greatly the losers by the change.

The proof of the above position may be seen in almost every instance of the pulling down of a brick house, of modern and ordinary construction. The bricks which form the walls above ground are easily detached from each other, and cleared of the very weak and crumbling cement between; while in the walls of the cellar, or of the foundation courses, which were always in contact with moist earth, and therefore the bricks were kept moist, they are so closely ce-

mented together, that they can scarcely be separated and cleared of the old mortar.

The necessity of keeping up moisture until the cement has had time to "set," is seldom more regarded in the plastering of houses. This operation is often executed in the hottest and dryest weather, so that all the moisture of each coat is evaporated in a day or two. Theory would inform us, that if laid on in damp and cool weather, or after the close of summer, that plastering would be far more solid and durable.

SOME REMARKS ON THE PRESENT AGRICULTURAL CONDITION OF ALABAMA.

Extract from a private letter to the editor.

* * * * * *

The crops here are *now* most promising. A slight drought in June gave the planters just time to prepare their crops of *corn* and *cotton* for the finest of seasons, for the last two weeks. Both of these crops are now singularly promising; the last, much increased over the last year—even with us will be plenty. The last year, it is believed, has fully satisfied the state of Alabama of the *advantage*, as well as the *necessity*, of securing *at home* plenty to eat; and I do believe, that the bubble—the "Mississippi scheme" of buying one thing to make another—is completely burst, even with the Mississippians; and common sense, aided by that which makes even fools think, has brought the country back to the old wise, practical adage of the northern quakers, "*live within yourselves*"—as regards the necessaries of life.

For a planter to leave uncertainty connected with bread and meat, voluntarily, argues a state of mind not far from idiotism, particularly in a country altogether congenial to the production of these two perfect necessaries of human life. The last two years have furnished us with a singular proof how completely *mania*, amongst even the agriculturists of the country, can destroy the operation of good sound common sense. So perfectly had the mania sapped the brains of some, or rather taken possession of the cavity where brains ought to have been, that men coolly and deliberately began to give 12 to 1500 dollars for a common cornfield slave—and congratulated themselves on getting "such a bargain, of such a fine fellow." But the disease is fairly done. * * *

From the Farmers' Magazine.

MANGEL WURTZEL.

By Martin Boyle.

Mangel Wurtzel is a kind of *red beet*, not liable to be injured by disease or insects, and proof against the change of seasons. It requires loamy loose soil, and abundance of short and rich manure. It gives no unpleasant taste to milk or butter, (an objection which may be urged against turnips, and most kinds of cabbage)—quite the reverse. Pigs, as well as milch cows, are fond both of its leaves and roots. Sixteen or twenty perches under it, will support a cow, allowing her sixty pounds weight per day, for the five winter months; and half a pound of seed, which will cost about 1*s* 6*d*, will sow these twenty perches. From the 20th to the end of April, is the best time for sowing the seed; and those of you who are not likely to have your ground at that time ready, should sow in a seedling bed, in order to transplant when the ground is prepared; and in this case you should not put out the plants until they are about an inch in diameter, else they will not arrive at full size. The best way, however, is to sow the seed where it is to remain, and the process is as follows:—

Prepare your land as if for drilling potatoes--open the drills eighteen inches or two feet distant, the deeper the better, unless there is yellow clay at the bottom—fill them with short manure—cover them with four or five inches of earth—roll them lengthways, and then on the smooth and level top make hills with the dibbling stick, two inches in depth and about twelve inches apart, and into every hole drop two seeds, which are to be covered as the work proceeds. When the plants are about two inches high, you are to draw out from each hole the extra plant or plants, leaving of course the strongest and healthiest plant behind. Keep them clear from weeds, but do not earth them. If any of the plants appear to run to seed, pull them out, and transplant into their room, after stirring up the earth, and applying a little fresh manure, (and to the want of attention to this point the comparative failure of transplanted crops is to be attributed) other plants of mangel wurtzel, rape, cabbages, or Swedish turnips, which should always be in a reserved seedling bed, in case of failure in any crop. In September pull the leaves—[cutting them close to the crown will cause the root to rot if left in the field during the winter]—and give them to your cows, sheep, and pigs. You will also find that they make a good substitute for greens or spinach.

The following is Mr. Meadow's calculation of produce:—

Drills 2 feet distant, Plants 2 feet distant,	220 plants per perch—23,280 per acre.
Drills 2 feet distant, Plants 18 inches distant,	147 plants per perch—23,580 per acre.
Drills 18 inches distant, Plants 1 foot distant,	294 plants per perch—47,040 per acre.
Drills 18 inches distant, Plants 11 inches distant,	252 plants per perch—40,320 per acre.
Drills 18 inches distant, Plants 18 inches distant,	196 plants per perch—31,360 per acre.

You may safely calculate on 30,000 plants per acre. If you average the plants at 3 lbs. each, which is much too low, you will have 90,000 lbs. or about 40 tons, not of a watery substance like turnips, but a firm nutritious food.

From the Farmer's Magazine.

THE LEAVES OF MANGEL WURZEL SHOULD NOT BE PULLED.

At Hohenheim an experiment has been made the past summer to ascertain comparatively the best plan to be pursued with the cultivation of Mangel Wurzel—whether it was more profitable to pluck off the leaves about a month previous to the clearing the roots from the ground, or allowing them to retain their *leafy honors* until the period of their being taken up; and the following is the result of two equal portions of a field on which the system were tried:—

On the 11th Oct., by leaves,	756 lbs.
5th Nov. ditto, at time of securing the roots,	272
Ditto, weight of roots,	4472
Total,	5500

The other portion of the field yielded, at the time of securing the roots

5th of Nov., by leaves,	894 lbs.
Ditto, weight of roots,	4948
	5842

On that moity of the field where the roots had been untouched, there was a diminution in the produce of leaves of 134 lbs., but an increase of 476 lbs. in the roots; and even supposing that the leaves have equally nutritious properties with that of the roots, yet there is a superiority in favor of the system of permitting the root to come to maturity before depriving it of leaves of 342 lbs., or about 6 per cent.

From the Farmer's Magazine.

SQUIRRELS—THE DUKE OF BEAUFORT'S FORESTERS.

It is a curious circumstance, and not generally known, that most of those oaks which are called spontaneous are planted by the squirrel. This little animal has performed the most essential service to the British navy. A gentleman walking one day in the woods belonging to the Duke of Beaufort, near Troy House, in the county of Monmouth, his attention was diverted by a squirrel, which sat very composedly on the ground. He stopped to observe his motions; in a few minutes the squirrel darted to the top of the tree, beneath which he had been sitting. In an instant he was down with an acorn in his mouth, and after digging a small hole, he stooped down and deposited the acorn; then covering it, he darted up the tree again. In a moment he was down again with another, which he buried in the same manner. This he continued to do as long as the observer thought proper to watch him. This industry of the little animal is directed to the purpose of securing him against want in the winter; and it is probable his memory is not sufficiently retentive to enable him to remember the spot in which he deposited every acorn. The industrious little fellow, no doubt, loses a few every year; these few spring up, and are destined to supply the place of the parent tree. Thus is Britain in some measure indebted to the industry and bad memory of a squirrel, for her pride, her glory, and her very existence.

From the Veterinarian.

ON THE PRINCIPLES AND PRACTICES OF SHOEING HORSES.

"*Horses shod on the most approved principles.*"—"*Horses shod on the expansion principle.*"

I have noticed this over many forges in and about the metropolis, and allude to them now, not with the intention of inquiring into the *principles* of either, for the very plain reason that I have never yet known of horses having been shod upon principle, *i. e.* agreeable to the laws of nature, and admitting of no deviation. The perfection of this art, like others, would of necessity be that which came nearest to nature, or, strictly speaking, it would not be art.

I long ago *discovered*, for myself at least, the sophism that has misled the veterinary profession upon the subject of shoeing, to be the *making principles* out of their practice; and, if we only go back to the period of the foundation of the college, we have had systems of shoeing enough, every one knows, but not one upon *principle;* and, we believe, no one will attempt to deny the definition of a principle; the result has been, that these systems, or, more properly speaking, modifications, have never come into general use. The ordinary method of shoeing is still practised throughout the country: the only difference I have observed, is more or less superiority of workmanship, for which, difference in price is charged. It is not, therefore, altogether true, that the low price paid for shoeing is the cause that these modifications have not come into use. Do the smiths of Newmarket never get £20 for plating a winner? And is this not sufficient stimulus to produce something practically useful, to save the feet and legs of racers over the hard heath in summer, and frost, from the effects of percussion?

Do not sportsmen pay high prices for shoeing hunters? Are coach-proprietors, and others, so blind to their own interests, that, if any of these modifications had been as advantageous as their proposers thought, they would not have used them also? The style in which some of them do business is a sufficient answer that *price* would not be studied by them. I will not say it is a disgrace to the veterinary profession; for many of its members have shown an ardent desire, and this too, at some sacrifice of time and money, to bring what they individually thought advantageous into general use. All have, however, more or less failed. I will endeavor to explain the causes of failure upon the ground of *principle*, or, rather the want of *principle*, upon which the whole profession, with few exceptions, seem to have been influenced. Most of them have made principles matter of inference from their practice, few from direct inquiry; and these have always been bewildered by practice also: having no principle to go upon, they could never fairly emancipate themselves; they were slaves of the forge—with ideas tied down by so much per set of shoes, leather soles, stopping, and all.

Mr. Moorcroft was well aware of the cause of the degradation of this art, and, with the intention of striking at the root of the evil, I had constructed by machinery his modification, with which I have nothing to do at present; but had he been able to make shoes, of any form, at fourpence each, instead of eightpence, he would have succeeded: but, confining himself to modification, he failed, and, I once heard him say, at the sacrifice of a greater sum than would now, in the present state of machinery, fully accomplish the object. Who will attempt any thing in the present state of the *trade?*—art it cannot be called.

The next attempt was accidental, originating in Mr. Goodwin having pattern shoes cast by Mr. Dudley; but he would not listen to the profession which applied to him for the shoes in ordinary use, and *fullered*. I though at the time how it would

end. Mr. Goodwin's modification began, and the panic of 1825–'26 put an end to the use of cast shoes. I was sorry for Mr. Dudley, and wished he had not committed the same error as Mr. Moorcroft and others; for I know, from practical experience, that the shoes might have been in use still. With the forms of the ordinary shoes, the patent is nearly out; and, if Mr. Dudley does not get a renewal, by application to parliament, some one else will attempt its introduction again; as a *discovery*, probably,—we have so many of them now-a-days. The shoes must be those in ordinary use; for I think it improbable to reconcile the conflicting opinions that exist on this subject in one shoe. I will attempt to explain this.

The common shoes have a flat surface next the ground; that next the hoof more or less concave, except at the heels, where they are flat, varying in substance, and oftener thicker at the heel than at the toe. The web is broader, according as the shoe is larger in size, and fullered in heavy shoes, sometimes counter-sunk nail holes, and nailed to the crust while the hoof is raised from the ground. There is no space between the hoof and the shoe, and, to prevent the percussion which of necessity occurs from the weight of the horse upon the hoof when the shoe thus applied bears on the ground, the sole is pared, so as to allow of its descent. This acts as a spring, and the percussion is prevented in some degree. But percussion still happens opposite the heels and quarters, which cannot overcome the resistance opposed to the action of the hoof by the close application of the shoe. Now this is, we suppose, what is meant by "shoeing on the most approved principles," *i. e.* the practice approved by those who follow the *trade* of shoeing horses throughout the country. It was therefore inferred, that the principles of shoeing were, that the crust only should bear on the shoe.

Mr. Moorcroft recommended the sole to have a bearing on the shoe also, as it was found the sole could bear on the shoe without injury. This upset the *inferred principles;* but an endeavor was made to reconcile this inconsistency, by explaining that the reason was, that the sole at the toe was not opposed to sensible parts; that the principles were the same, notwithstanding the exception; and practice showing that no bearing could be allowed of the sole on the shoe opposite the quarters and heels (the corn place, as it is called.) Now it so happens, that the crust at the heels is as much opposite sensible parts as the sole at those parts, and, for the same reason, should not bear on the shoe—it cuts both ways. The frog, too, is opposite sensible parts, and yet it was especially recommended for pressure by its bearing on the bar-shoe, where the aforementioned sensible parts, opposite sole and heels, could have no bearing and pressure.

I was strangely puzzled to understand such logic as was attempted by these inferences from practice, and resolved, on the first opportunity, to institute direct inquiry into the matter. What was the result?—that the sole, frog, bars, crust, whether or not opposed to sensible parts, were bearing on the ground without injury being produced in horses without shoes, just in proportion to the *substance* the unrestrained action of the hoof preventing all percussion; and that the same held good where horses were shod in those countries where great substance of hoof is left, and little substance of shoe is required, percussion and injury to sensible parts not happening there also. It is quite a mistaken notion to suppose that Englishmen do not go the pace in any other country but England; yet, although exposed to all that has been considered as the predisposing causes in greater degree, and the proximate cause in the rate and continuance of progression being equally as much, lameness does not often happen. In England, in the metropolis, and large towns, where higher prices are paid for shoeing, where the workmen are most skilful, where horses are what is called neater shod, where most substance of hoof is removed, agreeable to the supposed principles of shoeing, there are more lame horses than in the country, where the workmanship is rougher. I would rather have our horse shod in the ordinary way by the latter than the former, to go over the stones of the metropolis, where percussion is most likely to happen.

"The expansion principle" is a strange misnomer: it seems to imply that the hoof expanded; that hard and soft parts within it expanded also, which the anatomy and physiology of the foot deny. The superincumbent weight of the animal, not supported by the springs within the hoof, must ultimately fall perpendicularly on the last spring, that formed by the bases of the hoof on the sole, bars, crust, and frog. We did not copy this puffing announcement from any particular forge; but in every part of the country, and the metropolis too, we have this "shoeing on improved," and on "new," and "the newest," and "the most approved," and "patent," and "Professor Coleman's," and "college," and "veterinarian," and "expansion principles:" and, added to this, and in perfect keeping, "Veterinary surgeon, smiths' work in general, and bell-hanging in all its branches;" while Mr. Coleman's patent, and other shoes *gilt*, occupy the upper corners of the board, and a frying-pan and a gridiron ornament the lower ones, and a goodly row of pots, pans, and kettles, fill the window. Out upon it! Are we come to this? The man who has a sign board just over Bow Bridge, "all kinds of beasts *gelt*," is more a veterinary surgeon, and to him we recommend the public.

"*Principles most approved*," and "*Expansion*" appear to be distinct: there is a division as to the mode of receiving the weight from the last spring to the shoe, and ultimately conveying it from the shoe to the ground: the prevailing party believing that the structure and physiology of the foot and hoof consist of springs; that there is a depression of the sole, bars, crust, and frog, when the hoof is on the ground, and a recession of these parts when the foot is in the air; the substance of the sole is sacrificed to effect this depression of the sole, but no space is left between the heels and shoe to admit of the depression of the crust at the heels, which are opposite to sensible parts, as much as any portion of the sole. Both in light and heavy horses the consequence is percussion and alteration of form, often incurable lameness.

The inferred principle has been carried on more by the college and its students than by others, the modifications of Mr. Coleman having all this tendency, extrinsic to the form of the shoe. We were instructed to pare the soles of light horses, in some cases, as thin as paper, till they were pliable under the thumb, and to be particular in making the sole concave opposite the seat of corn; the effect of which was, to give this depression of the

sole; but in heavy horses it increased the predisposing cause of corns, by destroying the substance of the sole; and the crust at the heels was sooner destroyed by concussion against the shoe, which then bore on the sole also. The bar shoe was then had recourse to, and, to carry out the *principles*, it was said, that, as the public required one shoe to do for all horses, the bar shoe was the only one applicable; but having been used only in extraordinary circumstances, the public will not use it as an ordinary shoe. Mr. Powis used it without the bar; but the Levarian shoe, as we believe he called it, though having a space between it and the heels at the time of application, so as to admit of the action of the hoof, yet, after a few days, by the closer approximation of the shoe to the hoof, that space became less and less, and, before it was necessary to remove it, the hoof bore on it as in the ordinary shoe.

But the bar shoe, or used without the bar, or the frog bar shoe, clearly and distinctly upsets the *inferred principle*, that crust should bear on the shoe, and sole should not. Let us, therefore, hear no more of such nonsense, from any one professing to have the least practical knowledge of shoeing horses. There is no principle that can be uniformly practised without injury. The predisposing and exciting causes of injury of the foot are not acting upon all horses.

I have got rid of all technicalities, to enable us to come to some conclusion as to what really are the *principles* of shoeing horses. I have shown clearly enough, from general practice, that the crust only is allowed, or part of the sole also, at the toe to bear on the shoe, till it can bear no longer at the heels: the weight is then thrown on the frog, if in a sound state to bear on the shoe, until you can get the heels in condition to bear on the shoe again. If we are to infer principles from all this, what is the result?—That depression of the sole, bars, crust at the heels, and frog, should be allowed in the sound state of hoof that is used for its relief when diseased. I am aware that the subject is full of difficulty; it all hinges upon practical utility, *i. e.* whether the ordinary shoes can be superseded by those upon principle at the same price. Independently of this, it is easily accomplished, as I shall hereafter show, but not upon the theory of *expansion*, which is not the principle of action in the hoof, but that of the spring.

"It would be a very easy matter to give instances of the advantage derived from springs, by calculating assumed cases; but they seem to be quite unnecessary, since the general principle of changing percussion into increase of pressure, must, by its very annunciation, give evidence of its immense importance."—*D. Gilbert, Esq., M. P., on the Construction of Mail Coaches.*

"So great is the advantage of springs, that they almost annihilate the resistance which that part of the load which rests on them would encounter without them, upon stony roads, or rough pavement. From the whole of these experiments, it appears that the advantage of springs increases with the increased velocity of carriages."—*R. L. Edgeworth, Esq., F. R. S. M. R. I. A. Essay on the Construction of Roads and Carriages*, 2d edit. p. 118.

Springs.—They convert all percussion into mere increase of pressure; that is, the collision of two hard bodies is changed, by the interposition of one that is elastic, into a mere accession of weight Thus the carriage is preserved from injury, and the materials of the road are not broken; and in surmounting obstacles, instead of the whole carriage with its load being lifted over them, the springs allow the wheels to rise, while the weights suspended upon them are scarcely moved from their horizontal level, so that the whole of the weight could be supported on the springs, and all the other parts supposed devoid of *inertia*, while the springs themselves are very long and extremely flexible. This consequence would clearly follow, however much it may wear the appearance of a paradox, that such a carriage may be drawn over a road abounding in small obstacles, without agitation, and without any material addition being made to the moving power or draught."—*Gilbert.*

"A carriage without springs, moving over a rough road, has to be lifted over obstacles, or out of depressions, and all the power expended in overcoming *inertia* is pure loss: but the force exerted in elevating the weight is in a great measure [required] by the preceding or subsequent descent. Now, under the supposition in my paragraph, *inertia* would be destroyed; and it already is so by springs now at present used, and by the smooth roads."—*Gilbert.*

It would be useless to multiply quotations on the principle of springs. The principle of springs is acknowledged and taught in our veterinary school as the principle of action of the hoof and part within it. The seceders go upon a supposed expansion horizontally: they have failed, as others before them, in not being able to bring the modification of expansion into general use. Springs, too, have failed; and for the same reason—their application to prevent contraction. For springs to be brought into general use instead of the ordinary shoes, they must have the ordinary shoes for their basis. It must produce as much profit to the *trade*, not forgetting that intellect in its march has, as yet, forgotten to go the rounds of the *veterinary forges*, the new name for the blacksmith's shop, in *contradistinction*, I suppose, to that of the whitesmith.

[*To be continued.*]

From Lewis's Observations on Experimental Farming.

ON THE NATURE AND APPLICATION OF MANURES.

As no department of agriculture would be more under the immediate control of the manager of an experimental farm than that which includes the composition and application of manures, it might be reasonably expected that he would be able to confer advantages proportionally great upon the agricultural community. It may be said that in no branch of the profession is there more unnecessary waste incurred. Indeed, one of the greatest chemists of modern times has not scrupled to assert that the dead loss occasioned by the present system of preparing manures varies from one-half to two-thirds of the whole amount; and when we consider that the annual value of manure in Great Britain and Ireland is estimated at the gross sum of 20,000,000*l.*, we may form some idea of the saving that would ensue were the process conducted on more sound and scientific principles. At present, we would conclude that there is a loss

at least of one-fourth by the system generally pursued.

On surveying the manner in which manures are at present prepared and applied, we are at a loss to detect the slightest approximation to system in the whole process. Whatever may be the rules and axioms to which farmers consider themselves bound to adhere in other departments of their profession, one and all of them seem to think themselves entitled to take their own way in this. The consequence of such an indiscriminate mode of procedure is, that in the general, and (as they think) justifiable negligence, which, if not openly advocated, is at least most sedulously persisted in, the true principles and proper practice are entirely overlooked.

It must be well known to our agricultural readers that it was the opinion of the late Sir Humphrey Davy, founded upon a series of minute experiments, that manures suffered much loss in their nutritious properties from the decomposition being allowed to proceed too far; and that in order to prevent this, only a very slight degree of fermentation should be permitted.

It is not our intention to defend all the conclusions to which this talented chemist was led. On the contrary we are of opinion that he perhaps carried his favorite principles too far, and that a greater degree of decomposition than what he contemplated is necessary to reduce the fibrous substance of vegetables so far as to afford nutriment to the plants. This, however, is a matter of no great consequence in the present discussion. If this theory be true in the main, we can be at no loss to perceive that the present mode of preparing manures so generally followed by farmers, is as much opposed to it as any two extremes can well be. By throwing the dung and litter loosely together into one general mass, as a natural consequence, a constant fermentation is kept up, and the gases, which, according to Sir H. Davy, form the only valuable properties of the manure, are exhausted and dissipated in the atmosphere.—The soluble, and therefore the richest particles are also carried down to the bottom of the heap by the rain, and thus escape at the lowest point of the area. And it is certainly by no means difficult to conceive that the remaining mass must consist in a great measure of the coarser and least nourishing parts of the deposite. Unnecessary fermentation, however, might be easily prevented by having the heap compressed. This may be done by allowing animals to tread constantly upon it, when suffered to remain in a court. When removed, the generation of the gases might be prevented by covering the heap with a sufficiently thick coating of mould.

It is also evident, in a case where there are so many and opposite chemical agencies in operation, that the utmost delicacy and attention are requisite to prevent injury. Were the distiller and brewer to allow the fermentation of their worts to proceed beyond a certain fixed period, instead of having a nutritive and palatable liquid, vinegar would be produced; and were they to prolong the fermentation still further, the residue would become putrid. Similar chemical changes are going on in the dunghill; the vinous, acetous, and putrefactive fermentations successively recur; and according to the common mode in which dunghills are prepared, where fresh stimulants are daily added to the old matter, these three diverse agencies are all in operation at the same time. What, then, must be the nature of that heterogeneous and mongrel product which is finally applied to the nourishment of vegetable life? We are aware that a theory, in all respects opposed to that of Sir H. Davy, has lately been laid before the public, the principle of which is, that the decomposition of vegetables cannot be carried too far, inasmuch as the product which is thus evolved is an elementary substance, in which all nutrition is centered. Without pretending to decide upon the comparative merits of these two theories, we would only observe, that whether the one or the other be true, the great majority of farmers do not act in accordance with either; consequently, in the event of any of them being proved right, their practice must be proclaimed wrong; and when the dictates of science are thus directly opposed to each other, and the opinions of practical men at variance with both, does it not show in a very strong point of view, the necessity of having an experimental farm, that the whole matter might be submitted to the best of all practicable tests, that of direct experiment?

At present, as Mr Cleghorn observes, no rule of universal application can be laid down on this subject. The degree of decomposition at which farmyard dung should arrive before it can be deemed a profitable manure, must probably depend on the texture of the soil, the nature of the plants, and the time of its application.

In general, clay soils, more tenacious of moisture and more benefited by being rendered incohesive and porous, may receive manure less decomposed than well pulverized turnip soils require. Some plants, too, seem to thrive better with fresh dung than others, potatoes in particular; but all the small seeded plants, such as turnips, clover, carrots, &c., which are extremely tender in the early stage of their growth, require to be pushed forward into luxuriant vegetation with the least possible delay by means of short dung. The season when manure is applied is also a material circumstance. In spring or summer, whether it be used for corn or green crops, the object is to produce an immediate effect, and it should, therefore, be more completely decomposed than may be necessary when it is laid on in autumn, for a crop whose condition will be almost stationary for several months.

We may be permitted to remark, that amid the many unsatisfactory hypotheses that are daily promulgated regarding this subject, in works on agriculture, there is one fact which appears to be most clearly established, although too generally overlooked. We allude to the benefits that result from the application of manure in a liquid state. It has been verified by experience that the liquid essence of the dunghill, when applied to grass during the winter, but more especially in the spring months, has the effect of not only adding to the weight of the ensuing crop, but of making it from three to four weeks earlier than it otherwise would have been. In Holland, where perhaps the action of manures is best understood, they are invariably applied in this state in raising every species of crop. But how stands the case in this country? Liquid manure is almost uniformly regarded as a nuisance, and in order to dispose of it with the least possible trouble, it is allowed to evaporate by the sun, or it is directed to the near-

est channel by which it may be conveyed to the ocean. This takes place, with very few exceptions, on almost every farm in Scotland; and when we consider the vast amount of rich and nutritive matter that is permitted to escape in the very same way from our populous towns and cities, the loss sustained is almost incalculable.

It may, perhaps, be said, that the beneficial effects of liquid manure are so well known as not to require any additional exemplification by means of an experimental farm. We have elsewhere observed, that farmers in general are so slow of heart to believe, so tremulously sensitive with respect to every innovation, as to resist all the plausibilities of theory, however, fascinating and inviting they may be. In the present instance, although they may not verbally deny that certain advantages may result from the application of liquid manures in certain cases, they excuse their own apathy and neglect by attempting to show that these advantages are more than counterbalanced by the trouble and expense attending the process. Although nothing can be more unfounded, no mere theorists will convince them of the reverse. Therefore, the very fact of an agricultural truth being so well established, and yet so generally and practically belied, instead of proving against the establishment of an experimental farm, is a very strong argument in its favor, inasmuch as it shows that improvements—real and radical improvements—will not meet with a ready or favorable reception from practical men, unless they be promulgated in a practical way.

But further, the operation of an experimental establishment regards not merely the composition, but also the application of manures; and here a new and hitherto untried field of investigation lies ready to be explored. Apart altogether from the preparation of them, it is sufficiently apparent that little or no certainty can be attained in their application, unless the constituent parts of which they are composed, as well as those of the soil to which they are to be applied, and the vegetables to be raised, be accurately ascertained by chemical analysis. The decay of animal and vegetable substances is nothing more than the resolution of organized forms into chemical constituents; and it is a well-established fact, that vegetables when decomposed afford many earthy and elementary particles, which it is more than probable could have been derived only from the soil, or the manures incorporated with it. It is therefore an essential preliminary to successful cultivation that the various elementary ingredients of the soil, and the manures to be applied to it, be ascertained, together with the relative proportions in which they exist, and that those plants only should be raised from it in which the same substances are found in similar quantities, and whose habits are best suited to its texture. For example, clover, when chemically analyzed, is foundto contain gypsum, or sulphate of lime. When sown successively on certain descriptions of soil, in a four or five years rotation, and carried [off], it very soon fails. This of itself affords a presumption that the failure of the clover is attributable to the exhaustion of that substance from the soil by the previous crops. But when it is also established that the cereal crops are altogether destitute of it, and consequently do not take it up from the soil, and that those soils on which the clovers fail are to a greater or less extent deficient in gypsum, the confirmation of the previous conclusion becomes so strong as only to be exceeded by the direct exhibition of gypsum, when applied to such soils, restoring them to their original fertility. This scientific mode, therefore, of applying manures, is far from being chimerical, as many of those who plume themselves on being *practical* would have little hesitation in stigmatizing it. Independent of the many direct proofs that might be adduced in support of it, we have only to survey the processes of nature in daily operation around us. There we see certain soils better adapted for the production of certain plants than others, solely because of their texture and constituent parts. So uniformly, indeed, is this the case, that in many instances the nature of the soil can be at once inferred from a knowledge of the plant it produces. Thus no one at all acquainted with the subject would hesitate to pronounce that soil *argillaceous* in which tussilago abounded—that *peaty* which was distinguished for the bilberry and heath—that *ferruginous* where the common or sheep sorrel was eminent—and so on with aquatic, calcareous, and saline soils—all of them being almost every where indicated by the appropriate plants; demonstrating most unequivocally that every plant naturally flourishes most luxuriantly, and in the greatest abundance, in those soils which supply them most plentifully with the chemical substances that enter into their composition.

Now, if this opinion be correct (and the present state of chemical science in relation to the vegetable kingdom goes far to prove that it is so) it is evident that many of the soils at present devoted to the production of those crops which are more common to the agriculture of this country, would receive more permanent benefit from an alteration in their constitution and texture, than from the most abundant supply of the richest manures. The materials necessary for this purpose are generally within the reach of every farmer, being seldom far distant; and although the original outlay may in the first instance be considerable, it will be amply and speedily repaid by great permanent advantages. For, in supplying organic matter, a temporary food only is provided, and on many descriptions of soil much waste is necessarily incurred by doing so; but in altering the composition of a soil, for example in rendering clays friable by a mixture of sand, and the reverse—in overcoming a superabundance of calcareous matter, by inducing a stratum of peat—in neutralizing the effects of the salts of iron, or any acid matter, by the application of quick lime, &c.—the fertility of the soil may be considered as permanently established. Less labor will be required to prepare it—less manure to enrich it. It becomes capable of attracting a larger proportion of vegetable nourishment from the atmosphere, of supplying the plants with a greater proportion of appropriate food; or if this should be exhausted, it is possessed of a greater capacity for receiving and retaining such foreign organic substances as may be incorporated with it, and thus of producing its crops with comparatively less expense.

But what is the present practice? Almost all that is yet known upon the subject, is, that the application of manures is necessary to the continuance of production. The farmer, no doubt, can tell generally the nature of the soils of which his

farm may be composed, but to show how very little importance he attaches to this sort of knowledge, it may be sufficient to mention, that, in the great majority of cases, no distinction whatever is made in the mode of cultivating them. Acre for acre—all of them successively receive about an equal quantity of manure, of a similar kind, and almost the same treatment. Can it be doubted then, that much of the manure is thus thrown away? And is it to be wondered at that a return proportioned to the expense of cultivation is so seldom received?

It may be asked how an experimental farm is to remedy these evils, since every farmer has it in his power to obtain an analysis of any soils, manures, &c. he may choose, there being many individuals in every county well qualified for the task. We do not indeed expect that the various soils in Scotland are to be analyzed and registered by an experimental establishment; but manures may, and all the products of agriculture may. This, however, is not the mode of operation which, in the present instance, we would deem the most effective. It is not, however, so much from the individual analysis which the manager of such an establishment might find it his duty to institute and promulgate, that the most substantial benefits would be secured to the country, but from practical examples which would thus be exhibited of the direct advantages to be derived from following out the principles upon which it was founded; and, by consequence, from the inducements which would thus be held out to every farmer to embark in the same course. Were such the case, we have no doubt that the time will soon come when the different species of soil will be so nicely discriminated and classed, and the action of different manures, compound and simple, so accurately ascertained, in so far as it affects any given description of soil, that the farmer will know what particular quantity, and what particular species of manure he ought to apply in every circumstance on each acre of his farm, in order to insure the greatest possible production, and that chiefly by means of authenticated and accurate experiments. Any effort that has yet been made has been directed chiefly to ascertain the relative effects of different kinds of manures, without taking into account the varieties of soil to which they may have been applied; and although the experiments have been conducted on so limited a scale that no great dependence can be placed on the results obtained, still they may give some idea of the importance of the subject, and of how much remains to be done. In an experiment recorded in Messrs. Drummond's Third Report, of the efficacy of various manures in raising potatoes, we note a difference of more than a half between the greatest and least quantities produced, in other words, while one manure raised a weight of 22lbs., another produced only 9½lbs. Now, were such experiments conducted on different soils, the component parts of which were accurately understood, and the results faithfully noted and compared, it will be found that the advantages likely to be conferred by such a mode of precedure on the practical agriculture of the country, have been rather under than overrated.

STEAM PLOUGH.

Our readers have heard of the steam plough which has been performing such marvels among the mosses at Bolton. Well! the said machine has been inspected by a committee of the Highland Society of Scotland, accompanied by an engineer, and as their report is exceedingly favorable, it is not improbable that it will be exhibited here at the great meeting which takes place in October next. But if you plough by steam, what, it will be said, is to become of the ploughmen?—Goldsmith's

"Bold peasantry, their country's pride,
When once destroyed, can never be supplied."

But the change from animal to steam-power, happen when it may, will be extremely gradual, even were we to suppose, which we are far from doing, that the invention is alike applicable in all situations. Locomotive engines, which succeed so well on railways, seem to be of little value on common roads; and, wonderful as is the progress of the mechanic art, the period must still be distant, should it ever arrive, when a power which stops not, nor readily turns aside, can, by possibility exert the same supremacy over precipitous or stony heights, that it has done, and still is doing, over improvable moss, and other descriptions of land of the same level.—*Dumfries Courier.*

From the New York Courier and Enquirer.

ELECTRO-MAGNETIC MACHINE.

The boldness, ingenuity and perseverance of the inventors of this machine have been crowned with a success in their experiments thus far, which leaves little room for theory, or for doubt of eventual triumph. The application of electro-magnetism to numerous and important mechanical purposes, is no longer matter of question, even if no greater power were attainable than that which we lately saw in actual operation. This invention of Messrs. Davenport and Cook, if brought into use upon a large scale, which we have now full right to anticipate, is destined to produce consequences that almost baffle calculation. The immediate result would be the speedy substitution of electro-magnetic engines for nearly all other motive and mechanical powers now in use. Results would follow as mighty as those which steam has wrought in the industry and intercourse of mankind within the last fifty years. It appears to be now established by the very satisfactory experiments of these gentlemen, that the power is capable of indefinite increase, and there seems no more difficulty in calculating the increase of power from increased proportions in the different members of the apparatus, than there is in the same calculation of the force of a steam engine, of given dimensions and proportions. It is most confidently anticipated (and we think from satisfactory data,) that this new power will possess very decided advantages over steam, in point both of compactness and weight of apparatus. That as great a power may be obtained, for instance, from such an engine weighing two tons, as is usually obtained from a steam engine occupying double the space, and weighing three tons.

But in point of economy—the grand desideratum in all engines—the electro-motive power will possess the advantage still more decided, if the calculations of which we have heard are found to be correct, of the expense of working such machines of larger size.

In *construction*, the saving will be immense. In safety and durability, there can be no comparison. All the disagreeable and dangerous accidents, too, by steam, are at once removed. There is no noise—no smoke—no whizzing of steam—no bursting of boilers. The most irresistible of all mysterious and wonderful agents of nature operates its miracles in perfect silence and repose. The same terrible element that is seen in the most vivid and appalling flash of lightning—the same that awes us in the rolling thunder—that in the dreaded thunderbolt topples down the proudest turrets, and the strongest spires from their giddy heights—or uproots from their foundations the firmest walls—the hugest oaks—and the most impregnable fortresses—is here seen chained and subdued, like the galley-slave at his oar, laboring peacefully and unresistingly in any occupation that human ingenuity and caprice may assign to it. We do not speak of what may be, but what is already accomplished. Yes—in the country of Franklin—who first drew the lightning down from the clouds, and played with it in his hands—at the distance of little more than half a century—have two natives of the same soil, been the first to convert the same great element to a useful and humble servant of mankind. In the view of this sublime result—if we may justly say of Franklin, "*fulmen eripuit cælo*," we may almost say with equal justice of these inventors, that they have learned how we may

——"Wield these elements,
"And arm us with the force of all their regions."

Even, as we have before observed, if no greater power were attainable than what they are now daily exhibiting—what we had ourselves the other day the pleasure of seeing in full and triumphant operation—they have invented a machine, which is capable of being applied more economically to a vast variety of manufacturing purposes than any other known power. For goldsmiths' and silversmiths' lathes—for silk and other reels—for cotton spindles, for an infinite variety of polishing purposes, for glass cutters, for ivory turners, &c. &c., it is an invaluable power. In illustration of this, we may mention the fact that a goldsmith of this city who witnessed the operation of the smaller machine, offered the proprietors $25 for it, for his own manufacturing purposes. Such machines, it is supposed, might be constructed for five or six dollars. The larger machine makes from 1000 to 1200 revolutions per minute.

At the same time, in announcing these brilliant results already attained by our ingenious and meritorious fellow citizens, we desire to impress upon the attention of intelligent capitalists, that to put this motive power into operation, upon a scale commensurate with the public wishes and expection, it is necessary that the remaing shares of the 200 which are offered for sale, should be taken up, and the principle will then be at once put into operation upon a scale which will satisfy the most incredulous. Surely, when they reflect upon the vast importance of the results to be obtained, and now within reach, they will not hesitate to come forward and take some few shares in an undertaking which promises so rich a harvest of profit, as well as so incalculable a benefit to our country and mankind in general. The whole interest in the invention now secured by patent in this country and Great Britain, and arranged to be secured in the rest of Europe, is to be the property of the share-holders who now engage in the undertaking. The two hundred shares out of 3000 in which it is divided, now offered to the public, are only intended to furnish capital enough to make an ample experiment, and no more will be offered until that shall have been thoroughly done. E. Williams, esq., the agent and trustee of the proprietors, has made already great progress in perfecting these arrangements; but an adequate capital, for the contemplated experiment on a large scale, will require the sale of the whole 200 shares. When that has been accomplished, if the result is satisfactory, the value of the stock, will, of course, be enhanced in a proportion which we need not now calculate. But at all events, enough has already been established of the utility, as we said before, of this invention for different manufacturing purposes, to make the stock valuable, if no greater power should be gained.

If the rough estimate we have formed, of the power of the machine we saw in operation, be any where near correct, and the increase is only in strict proportion to the increase of proportions, we know of no power in use capable of exerting an equal force within the same dimensions.—Our estimate is based upon what we saw it actually perform, and we rate it below what others who have witnessed it, have supposed it to be in reality.

At all events, this successful application of the mysterious power of galvanism to mechanical purposes, forms a most remarkable era in the history of sciences and mechanical skill. We regret that the numerous demands upon our columns prevent us from giving various calculations and descriptions more in detail, which would tend to elucidate the vast importance of this subject to the community. Those, however, who feel disposed to take an interest in the enterprise, and to hasten its application to navigation on a scale that may test its practicability in the fullest manner, may easily avail themselves of a personal inspection and examination, upon applying to the agent of the proprietors, at his office, 76 William Street. The explanations given by Mr. Cook himself, will enable them to duly appreciate the ingenuity and power which are beautifully illustrated in the model we have viewed with so much pleasure.

REMARKS ON OVERSEERS, AND THE PROPER TREATMENT OF SLAVES.

To the Editor of the Farmers' Register.

Fredericksburg, August 5th, 1837.

Some of the contributors to your periodical are advocating a system of farming, so far as it refers to our slaves, without the aid of overseers—substituting a scheme of pecuniary rewards according to merit, and withholding them for want of it. On small farms, when the owner is an active energetic man, he may manage his concerns well enough without aid; but on farms of 800 acres, or more, I think he will find it a difficult task to manage his negroes unless assisted by an overseer.

When negroes are accustomed to an overseer, and you dispense with the services of one, they *must* be exposed to a great deal of temptation, far

more than they can resist. And education has not taught them the difference between right and wrong; at any rate, their ideas on the subject must be confused. What they learn of the moral code, is gathered from observation, and the example of others, their superiors. How can any person, who, has no overseer, be all at hours with his negroes, when he is delivering his grain for example. Let him turn his back, and a cunning fellow will help himself to a bushel of corn or wheat, and he will never be informed upon by his fellow laborers, though ever so honest; for an informer, in their eyes, is held in greater detestation than the most notorious thief.

I admit that many overseers are vain, weak tyrants, "dressed in a little brief authority," but probably a larger proportion of farmers of Virginia are indifferent cultivators of the soil. I regard an overseer as an indispensable agent, whose first qualities should be honesty and firmness, united with forbearance and good temper. Sobriety is a *sine qua non*. A written agreement should be drawn up between the employer and the employed, to be signed by both, setting forth the terms, and mentioning the most important requisitions, which will occur to every one. An overseer's wages should always be paid in money; for if you give him a part of the crops, your land will be worked to death, and never have a dozen loads of manure spread upon it. In addition to this, your views and his will frequently come into collision.

Your overseer should be treated with marked respect; for if you treat him contemptuously or familiarly, your authority and his are injured. He should not be allowed to strike a negro with his fist or a stick, nor ever to punish with severity; for it is not the severity, but certainty of punishment, that wins implicit obedience.

The subject before me turns my thoughts to the food, houses, and clothing of the negro. The master shold ever bear in mind, that he is the guardian and protector of his slaves, who if well treated and used, are the happiest laboring class in the world.

Clothe your negroes in warm yarn home-made stuff in winter, with yarn stockings knit at home, and two shirts, and linen for the summer. Their shoes should be well made, and mended two or three times during winter. Give them great-coats, hats, and blankets, every other year, so arranging the matter, that one of the articles is distributed every year—hence it is not so felt by the farmer as if all were given the same year. The clothes of the men and children should be *made* for, and not given out to them to have made. The women can make up their own clothes, and those that work out should have a short kind of great-coat. The youngest negro child on your farm should be clothed.

The cheap and light straw hat in summer will add greatly to the comfort of your laborers.

Potatoes, cabbage, turnips, and peas, boiled with beef or bacon, will give your negroes a wholesome meal, for breakfast or dinner; at the other, they should have fish, or the same. With a little attention, the above named vegetables will last for twelve months. Occasionally, fresh meat will be required.

Their houses should be warm and close—not such as are constucted of the common fox-tail pine, with the bark on.

Liberally and plentifully fed, warmly clad and housed, your negroes work harder and more willingly, will be more healthy, and their moral character be improved, for they will not be urged, by a hungry longing for meat, to steal their masters' hogs, sheep, and poultry, or to make predatory excursions upon his neighbors. Your negroes will breed much faster when well clothed, fed and housed; which fact, offers an inducement to those slave owners, whose hearts do not overflow with feelings of humanity.

The character of the negro is much underrated. It is like the plastic clay, which, may be moulded into agreeable or disagreeable figures, according to the skill of the moulder. The man who storms at, and curses his negroes, and who tells them they are a parcel of infernal rascals, not to be trusted, will surely make them just what he calls them; and so far from loving such a master, they will hate him. Now, if you be not suspicious, and induce them to think, by slight trusts, that they are not unworthy of some confidence, you will make them honest, useful, and affectionate creatures.

Having permitted myself to write more than I intended, I will only add, that, if you find these remarks do not suit your purpose, give them to the flames, and oblige, yours,

H.

From the Cambridge (Md.) Chronicle.

LARGE SUGAR BEET.

We saw yesterday a fine specimen of a crop of sugar beet (species "white Silesian") from the farm of Dr. Muse near this place. The beet which was exhibited to us, was sixteen inches in circumference, thirteen long, and weighed five pounds and three ounces. Dr. Muse exhibited, on the fourth of July, a specimen of his beet, which measured eleven inches in circumference. The crop has much time yet to grow—and at *least* twenty-five per cent. increase, it is supposed, may be fairly expected, when fully matured.

ON HORZONTAL PLOUGHING—HILL-SIDE DITCHES—AND HAND-RAKES USED IN CULTIVATING CORN.

To the Editor of the Farmers' Register.

Goochland, July 30th, 1837.

I see that Mr. J. Du Val, of King and Queen, has made a trial with the rakes in weeding corn, and seems to be pleased with them, and my manner of ploughing to prevent land from washing. But he thinks I give too much fall. In that I can assure him he is mistaken. I will admit that three inches to twelve feet would be too much fall for a trench, that is thirty yards apart from the next above—because the quantity of water that would collect in that distance, would be so great, that it would wash a trench into a gully in a short time. But if it is laid off in twelve-feet beds, it is so divided that it does not wash at all, or so little that I consider it almost a perfect preventive. He says he runs a line of level every thirty yards. That may do in the lower country, where the surface of the hills is regular; but our highland is so undulating, that it will not do here.

I will explain as well as I can my way of laying off land. I commence at the top of the ridges and run my lines of level to the right and left down to the bottom of which I leave six or eight feet unbroken, for the water to run over to prevent its being washed in a gully. I run a line of level every forty or fifty feet, and in laying off my rows, I run a furrow alternately from the line above, and then from the next one below, until I meet in the middle, which divides the irregular surface of the land, that may occur between the lines of level, and prevent the water from being carried the wrong way. Whereas, if you commence at one line, and continue on the same side until you get to the next, you will, in many places, increase the fall too much, and in others lose it altogether, and carry the water the contrary way, and defeat your object entirely.

Some think that I do not give fall enough. Steep land requires more fall, than land that is moderately rolling. But it is not material, whether you give little more or less fall, so that you be sure to give fall *all the way*. In regulating the width of my rows, I attach a measure to the beam of the plough, just in front of the share, with a hinge, and tie a stick or switch 18 inches long to the end of it, which drags in the furrow above; and when you get to the end, you can turn it over, thereby do away the necessity of leading the horse with a pole attached to his mouth. And it gives you the width of your rows opposite the plough, where it should be. It is necessary to fix pieces to the sides of the plough for the measure to rest on, to prevent the end from dragging the ground. If your field is properly laid off in this way, there is no necessity for a hillside ditch or furrow. Except, where you have a hillside in cultivation only a part of the way from the bottom, it is necessary to have a hillside ditch to catch the water that collects above, to prevent it from running over the cultivated land below; and when the ravine terminates on a branch flat, I have a horizontal ditch to prevent the water from running over the flat.

Mr. Du Val seems to think the account given as to the quantity of work done by the rakes rather extravagant. Perhaps it may be; but it requires some practice to use them to advantage, and some attention at first of the overlooker, to make his people keep up with the rake; or they will stand and scratch in one place much longer than is necessary to do the work well. I raked over a field of forty-five acres this spring, with three hands in six days; and one of them was a boy of twelve years old, and badly grown, and another a girl of fourteen, and the other a free boy. Now, I doubt whether nine men with hoes could have done it in that time, and at that stage of the corn.

It is with pleasure that I communicate any thing I know about farming, and nothing would gratify me more than to hear that any one had been benefited by any thing that I have said on the subject. But my capacity for writing is very limited, and I shall hold you responsible for any blunders that I may make being in print, and hope you will correct me where you see cause.

Yours,
Respectfully,
THOMAS B. GAY.

THE INJURY CAUSED BY FEEDING ON CORN FROM NEW-GROUND.

To the Editor of the Farmers' Register.

Baker County, Ga., June 25th, 1837.

* * * * And here, perhaps I ought to close my remarks. But as I am a young farmer, and wish to educate myself to agricultural pursuits under your auspices, I shall make a few remarks, which, at least, may call forth the knowledge and experience of some "knowing one."

When I removed my farming interest, (last fall) from near Milledgeville to this place, some of the old settlers told me, if I could avoid it, not to purchase new-ground corn, because it would certainly kill horses, if fed on it constantly. Well, sir, I immediately fell to work with what little knowledge I possessed of botany and chemistry to devise a theory which would account for the alarming fact. But I was utterly unable to do so, and was a little inclined to treat the matter as an erroneous opinion. However, owing to the repeated solemn assertions of some of my oldest neighbors, I bought up as much old-ground corn as I could find convenient. But owing to the Indian disturbances in this county during the last summer, corn was scarce, and I had finally to buy the greater part of the reprobated corn. We commenced in the spring with fifteen or sixteen horses and mules, and after serving a pretty good apprenticeship to the art of veterinary practice, we have lost nine horses and one mule. I should, perhaps, have concluded that there was something in the climate, uncongenial to the health of the unacclimated horse; but a great many others who had been living here for years, were almost as unlucky as myself, having to feed on the same kind of corn. Such, sir, is the case in detail. I have made inquiry about the rearing and housing the corn, and I have come to this conclusion, that the crop was planted late, and the ears stript from the stalk before the corn was thoroughly dry, in order to have the advantage of an early pea pasture. It was then thrown, in large bulks, into cribs, with the shuck on, and the consequence was that the grains mildewed, and a great many rotted. This I think is the ostensible cause of the deleterious effects upon horses; but I am unable to investigate the chemical action, by which it is probable a cure may be devised. Our horses would shrink away to skin and bones, and finally die, with every symptom of staggers. The urinary organs seemed affected. Rest and good attention had no effect. We lost but one mule, (and that I think with colic.) Perhaps those planters who cut their corn green, and cure it, may be able to tell us something of the matter.

JAMES A. WIGGINS.

[Our correspondent states a remarkable and important fact, which we hope his communication may be the means of causing to be properly investigated, and the remedy, or preventive means afforded.

Though this injurious effect of the corn made on newly cleared land is new to us, we have heard of great mortality being produced among the horses on a large farm in Virginia, by their being fed on the corn damaged by too early housing, of the noted generally immature crop of 1816. There were scarcely any of us, in lower and middle Virginia, that year, who made

considerable crops, but had to remove more or less corn from the cribs, and to throw out much that was mouldy or rotten, which had been cribbed sound, and then thought to be sufficiently dry.

In newly settled districts, as a matter of course, land just cleared must form a large portion of the corn ground of every plantation; and the desire to "get in" as much new-ground as possible, must likewise make the planting, and consequently the maturing of the crop, unusually late. There can be but little doubt, then, that our correspondent is correct in his views of the cause of the dangerous quality of such grain.—And though the *rationale* of the change of nutritious to poisonous principles may be beyond our reach, at present, it is not difficult to prevent the worst effects. These preventive measures, would be to plant new-ground earlier, when practicable—and when late planting is unavoidable, to use seed of some early kind of corn; any of the flinty varieties would serve this purpose. But when neither of these safeguards have been used, and the grain is not fully matured, or dry enough, when cold weather arrives, danger may, probably, still be avoided, by leaving the corn standing sometime after, (or in small shocks if necessary to be removed,) and having it shucked, before being cribbed. It must be the partial fermentation excited (by dampness) in the bulk, and not the mere want of perfect maturity and dryness, before gathering, that causes the injurious effects of the corn as feed. For in the northern states, where corn is cut off in a still greener state, and cured by standing in small shocks, no such evil as this has been complained of. A similar practice prevails on the head waters of the Potomac in western Virginia, and elsewhere farther west, where the corn is used almost exclusively for stock, horses included; and there also, there have no such evil effects been found, or at least not made public. We beg, that any of our readers who can give information on this subject, will do so through the Farmers' Register.

From the American Farmer.

THE MORALS OF AGRICULTURE.

September 14th, 1822.

MR. EDITOR,

I wish that some of your correspondents, who have more leisure and more ability than myself, would take into consideration the subject on which I shall submit a few desultory remarks. If the morals of agriculture deserve not such attention on account of their importance, the subject is at least worth the notice, and is properly within the province, of all authors of *addresses* to agricultural societies. Most of these gentlemen appear to be so much at a loss for subjects, that their addresses would not be badly designated by the title of "*Essays on things in general.*" I, therefore, recommend this subject to any person intending to prepare an annual address, unless he really should have something else to lay before his society and the public.

The Hindoos believe that whoever plants a tree, digs a well, and begets a child, is sure of admission into heaven. As ridiculous as this part of their religious creed may appear, it shows the wisdom of their priests and rulers by whom it was instilled—who thus brought the strongest motives to induce every individual to increase the productiveness, population, and wealth of his country. When our ancestors emigrated from Europe, they wisely left behind them all their elfs, fairies, goblins, &c., and as it is impossible that we can long remain as we now are, free from popular superstitions, it would be a blessing to our posterity if we were to adopt, as one, the Hindoo tenet, so modified as to suit our different situation. We have no want of growing trees, nor of fresh water; and all experience proves that children will always be furnished fully as fast as the food necessary for their support. Population is always precisely proportioned to, or limited by, the means of subsistence, and in an agricultural country, must increase with the improvement of the soil, and decrease with its exhaustion. The farmer who makes his land capable of producing annually 500 bushels of grain more than before his improvements commenced, increases permanently the population of his country, by as many persons as his increased product will support. Another, who spends his life in reducing the fertility of his soil by the same amount, diminishes population as much; and that diminution is more effectual and permanent, than if he had confined his exertions to cutting twenty throats of every successive generation.

"To increase and multiply" is a divine command—and perhaps is the only command which all persons strive to their utmost ability to obey. But though, the usual means may be the most agreeable, I beseech your readers to believe that they are far from the most effectual. It is true, that no harvest can be reaped unless seeds are first sown; but every child knows that it is not the greatest number of grains planted which ensures the heaviest crop of corn, but the means afforded for the support of the plants, by the degree of fertility in the soil. Just so with population. Only let bread, or the means of obtaining bread, be increased in any country, and its population will soon be equal to the increased supply of food. On the contrary, if bad farming, or bad policy in the government, lessen the production of food, the inevitable consequence must be a diminished population. These positions (which every sound political economist will sustain) show what vast effects the labors of a single individual may have on the welfare of his country; and what beneficial effects might be produced, if it was believed (more especially by all law-makers,) that he who directly or indirectly lessens the productiveness of the earth, is guilty of s sin, which, if more pardonable than murder, is far more injurious to the country, and more destructive of its population, than would be many murders.

But seriously—this subject deserves to be reflected on by all; it will give additional gratification and encouragement to the improving farmer, and furnish an impressive lessen to him who is pursuing a contrary course. It would be visionary to expect that the public good, alone, would induce improvement of the land at the sacrifice of private interest. Nor would it be desiable. A farmer can in no way do as much good for his country, as by pursuing precisely that course which is most profitable to himself. But though many at-

tempts to increase the fetility of the soil are ill-judged, yet there are means enough which are profitable; and there is no case in which the owner of a farm, can be most benefited by its exhaustion. The many, then, who waver between the two opposite cases, could scarcely remain uninfluenced by the *moral* consideration, that on the course of farming which shall be pursued by each individual, the comfort, nay, even the existence of thousands of human beings will depend.

For the purpose of illustration, I will compare the course of two cultivators of my acquaintance. N——, inherited a farm and stock, capable of well supporting an industrious and economical man, but which, if left to the sole management of an overseer, and treated according to the then usual practice, would not have paid the expense of cultivation for many years. Fortunately he knew what course would most promote his interest. For thirty years, he has not ceased striving to make two blades of grass, where one only grew before, and he has met with the success which his exertions deserved. He rejected all improvements (improperly so called) which promised not to return some clear profit on the capital invested, but considered no improvement too laborious or expensive, from which he could, *with certainty*, derive the principal and interest of the first cost. He bought no land which he was not fully able to stock, or that would not yield more clear profit, on the purchase money, than he could have obtained from investing the sum in making additional improvements on the land already in his possession. At this time, by means of improvement of the soil, and extended tillage, he makes crops six times greater than when he commenced. Though N——, has thus eminently promoted the public weal, it was without caring for it: his views were exclusively directed to the advancement of his own private interest. He is obedient to the laws of his country, and just and honest in all his dealings, because he knowns that such is his best policy; but in no case does he allow his interest to yield to that of others, and perhaps never performed an act of real generosity in his life.

F——, is directly the reverse of N——, in disposition, character, and habits. Indolent, and having no fondness for farming, his business has been entirely conducted by his overseers; and according to the usual maxims which very naturally govern such gentry, they have exhausted his land as fast as they could clear it. Nothing but the immense fortune which their employer possessed, prevented him from living as most landholders in lower Virginia have done, on all of his annual increase, and part of his capital. But F——, is moderate in his desires, and therefore not of expensive habits; and notwithstanding his bad management, his income has allowed him to continue purchasing land, until he owns almost as much as a German principality. By these means, his annual crops are not materially lessened, though every field is in its turn destroyed, and deserted for a new one. Though he does not obtain two *per cent.* from his capital, yet as still less sufficies for his support, he considers his wealth increasing as rapidly as the number of his acres. According to the usual calculation of profit, injury to the land is not taken into consideration. It is evident however, that the mode of cultivation pursued by F——, is merely abstracting the whole fertility of one field, in the form of tobacco, wheat and corn, and applying it to another in the form of purchase money. What was said of the famous conquerer and destroyer, Attila, "that the grass ceased to grow where his horse placed his foot," applies with more truth to my friend F——. Notwithstanding his many virtues, he has to the fullest extent which his means permitted, been the destroyer of grass, of grain, and consequently, of men. Famine marches after him, and will not commit the less havoc because he himself is able to keep beyond her reach.

F——; is remarkable for his kindness and liberality to the poor. Besides frequent occasional acts of charity to others, he has long supported several families, who would perish without such aid. I know how to estimate the motives, and according to them, to respect these two individuals. But their private virtues and vices, have nothing to do with my subject, except so far as the consequences of them affect the public good. F——, supports by his benevolence, twenty persons, and has destroyed the means of subsistence for 500, which in effect, is equal to starving, or preventing the existence of as many. N——, has given nothing in charity, but has given in the *wages of labor* more than F——'s wages and alms together: he has increased the production of the earth enough for food for 500 persons, and therefore he has increased population to that amount, though not at all by the Hindoo mode, as he has no children It is very true that these people must work to obtain N——'s increased product; and so much the better. His improvements will not die with him, nor will the corporeal powers of this laboring population, and their descendants or successors which will continue to earn and consume it. The country is not benefited only by having its population increased by 500 persons; if they were all drones, they would rather be an evil. But the people who eat N——'s corn are field laborers, mechanics, manufacturers, sailors, and merchants, all of whom are continually increaing the national wealth by their industry, as well as its strength, by their numbers. F——'s charity has served not only to support several families, but has doubled their number, by the births which have taken place since they partook of his bounty. After his death, they must still be supported by others, or starve. They are not able to add any thing by their labor to the public stock, and though the children will hereafter be able, their present situation is the worst of all schools to acquire habits of industry. Were all our land holders like N——, the wealth and population of the state would quickly be doubled. Were all like F——, with all his virtues, wealth and population would rapidly diminish, until the country became a desert. Thousands are pursuing the ruinous course of the latter; very few cultivate so as alike to increase the national resources and their own.

My opinon on this subject, taught me to expect but little increase in the population of Virginia, and not to be disappointed in the report, of the last census, which shows a gain of but ten per cent. in the last ten years. But for the recently awakened spirit of agricultural improvement, (the impulse to which, we owe principally to the author of Arator,) I think that the tide-water district would have suffered a considerable diminution. As much vacant land as this district contains,

there is but little uncultivated, (which until enriched) will yield any clear profit. Therefore, eastern Virginia, in its present state, is *fully populated*, and no increase can be expected *except from the improvements of the soil, and the consequent increased means of subsistence.* We export provisions, it is true; this may at first seem to indicate a surplus of the means for subsistence, and a fund for additional population. But such a conclusion would be incorrect. Our surplus food is exchaged for clothing and other commodities, which in fact, or from custom, are as necessary as sufficient food. Our only consolation is, that our excess of population emigrates to the west; instead of starving, as in most fully populated countries.

If private individuals can exert so much influence on the population and strength of their country, how much more extensive must be that of the government! A member of the legislature, by a single vote, may retard population more than by destroying the productiveness of all the land in his possession. A single bad law, which cramps ingenuity and industry, or destroys their honest gains, or what is worse, puts them into others' pockets, causes more poverty and depopulation than a thousand exhausting cultivators. Many are the sins of this description, which have been committed by our legislatures, both state and federal; it is enough to name as examples, the protecting duty policy, banking, and laws for the compulsory support of the poor. The last, though not the least of such evils, will hereafter become the heaviest. Poor laws impose taxes and penalties on honest industry, and offer rewards for idleness, extravigance, drunkennesss, and debauchery—and their inevitable consequence will be to increase those vices, until their support shall have absorbed the whole income of the industry of the nation. England has already drawn near to that dreadful situation, and with her example before us, we are pursuing the same course to the same end.

APPOMATTOX.

From Loudon's London Gardeners' Magazine.

ON THE SYSTEMS OF CROPPING KITCHEN GARDENS ADOPTED BY THE BEST PRIVATE AND COMMERCIAL GARDENERS—WITH AN ATTEMPT TO REDUCE THEM TO FIXED PRINCIPLES.

The subject of cropping the ground in kitchen gardens, embraces the preparation of the soil, the insertion of the seeds or plants, their after culture, the gathering of the crop, and the system according to which one crop is made to succeed another. As the discussion of all these points, however, would involve the repetition of what is already well known to every gardener, the article now submitted to the reader, and for which his indulgence is enteated, is limited to what is properly called cropping, or the succession of crops. Crops in kitchen gardens, are put in the ground according to three distinct plans or systems, which may be termed successional cropping, simultaneous cropping, and permanent cropping.

Successional Cropping, is that in which the ground is wholly occupied with one crop at one time, to be succeeded by another crop, also wholly of one kind: for example, onions to be followed by winter turnips, or potatos to be followed by borecole.

Simultaneous Cropping, is that in which several crops are all coming forward in the ground at the same time; for example, onions, lettuce, and radishes, sown broadcast; or peas, potatos broccoli, or spinach, sown in rows.

Permanent Cropping, is where a crop remains on the ground several years; such as sea-kale, rhubarb, asparagus, strawberries, &c.

To these modes might be added, *mixed ligneous and herbaceous cropping*, such as growing herbaceous crops among gooseberries, currants, raspberries, and other fruit shrubs, and among fruit trees. The practice of growing culinary crops among fruit shrubs is, however, nearly exploded in the best gardens, on account of the injury done to the shrubs when they are young and small, by the roots and shade of the culinary crops, and of the injury done to the culinary crops when the shrubs are grown up, by the shade and confinement which they produce. For the same reasons, cropping between trees, is by no means desirable in small gardens, where the trees must necessarily be at no great distance from each other; but in the case of very large gardens, such as those of commercial gardeners, where trees are planted in close rows at 20, 30, or 40 yards apart, so as to shelter the ground, the cropping may be carried on in the spaces between rows of trees, on the principles which regulate successional, simultaneous, or permanent cropping, in ground where there are neither trees or shrubs.

The object to be attained by a system of cropping is that of procuring the greatest quantity and the best quality of the desired kind of produce, at the least possible expense of labor, time, and manure; and, in order that this object may be effectually obtained, there are certain principles which ought to be adopted as guides. The chief of these is to be derived from a knowledge of what specific benefit or injury, every culinary plant does to the soil, with reference to any culinary plant. It ought to be known whether particular plants injure the soil by exhausting it of particular priciples; or whether, as has been lately conjectured by De Condolle, and as some think, proved, the soil is rendered unfit for the growth of the same or any allied species, by excretions from the roots of plants; while the same excretions, acting in the way of manure, add to the fitness of the soil for the production of other species. The prevailing opinion, as every one knows, has long been, that plants exhaust the soil, generally, of vegetable food, particularly of that kind of food, which is peculiar to the species growing on it for the time being. For example; both, potatos and onions, exhaust the soil generally, while the potato deprives it of something which is necessary to insure the production of good crops of potatos, and the onion of something which is necessary for the re-production of large crops of onions. According to the theory of De Condolle, both crops exhaust the soil generally, and both render it unfit for the repetition of the particular kind of crop; but this injury according to his hypothesis, is not effected by depriving the soil of the particular kind of nutriment requisite for the particular kind of species; but by excreting into it substances peculiar to the species with which it has been cropped, which substances render it unfit

for having these crops repeated. Both these theories, or rather, perhaps, hypotheses, are attended with some difficulty in the case of plants which remain a great many years on the same soil; as, for example, perennial-rooted herbaceous plants and trees. The difficulty, however, is got over in both systems: by the first, or old theory, the annual dropping and decay of the foliage is said to supply at once, general nourishment, and particular nourishment; and by the second, or new theory, the same dropping of the leaves, by the general nourishment which it supplies, is said to neutralize the particular excretions. It must be confessed that it is not very obvious how general nourishment, dropped on the surface of the soil, can neutralize the excrementitious matter deposited many feet beneath the surface; as in the case of long rooted herbaceous plants, like the saintfoin, lucerne, &c.; and deep rooting trees, such as the oak, &c. Nevertheless, we find that these plants will remain a longer period on the same soil than others, the roots of which never go to any great depth beneath the surface; such as the fibrous-rooted grasses, the strawberry, &c., and the pine and fur tribe. We mention these things to show that though it is not yet determined which is the true theory, yet that the fact of plants injuring or diminishing the fertility of the soil, both generally and particularly, does not admit of a doubt.

In the absence of principles founded on whichever of these hypotheses may be true, recourse is obliged to be had to rules drawn from the experience and observation of those who believe in the old theory. These rules, as adopted by the best gardeners, are as follows:

Crops of plants belonging to the same natural order or tribe, or to the natural order and tribe most nearly allied to them, should not follow each other. Thus, turnips should not follow any of the cabbage tribe, sea-kale, or horseradish.

Plants which draw their nourishment chiefly from the surface of the soil should not follow each other; but should alternate with those which draw their nourishment in great part from the subsoil. Hence, carrots and beets should not follow each other; nor onions and potatos.

Plants which draw a great deal of nourishment from the soil should succeed, or be succeeded by plants which draw less nourishment. Hence, a crop grown for its fruit, such as the pea; or for its roots or bulbs, such as the potato or the onion, should be followed by such as are grown solely for their leaves, such as the common borecole, the celery, the lettuce, &c.

Plants which remain for several years on the soil, such as strawberries, rhubarb, asparagus, &c. should not be succeeded by other plants which remain a long time on the soil, but by crops of short duration; and the soil should be continued under such crops for as long a period as it remained under a permanent crop. Hence, in judiciously cropped gardens, the strawberry compartment is changed every three or four years, till it has gone the circuit of all the compartments; and asparagus beds, sea-kale, &c. are renewed on the same principles.

Plants, the produce of which is collected during summer, should be succeeded by those of which the produce is chiefly gathered in winter or spring. The object of this rule is, to prevent two active and exhausting crops from following each other in succession.

Plants in gardens are sometimes allowed to ripen their seeds; in which case two seed-bearing crops should not follow each other in succession.

These rules, and others of a like kind, apply generally to the three different systems for the succession of crops; and they are independent altogether of other rules or principles which may be drawn from the nature of the plants themselves; such as some requiring an extraordinary proportion of air, light, shade, moisture, &c.; or from the nature of the changes intended to be made on them by cultivation; such as blanching, succulency, magnitude, &c. We shall now notice the different systems separately.

Successional Cropping.—The plants best calculated for this mode of cropping are such as require, during almost every period of their growth, the fullest exposure to the light and air; and as remain, also, a considerable time in the soil: these are, the turnips, the onion, the potato, the beet, the carrot, &c. If any of these crops are raised and brought forward under the shade of others, they will be materially injured, both in quality and quantity; though, at the same time, while they are merely germinating, shade will not injure them. Hence, successional cropping may be carried on in breadths of 20 feet or 30 feet, between rows of tall-growing articles, without injury; which approximates this manner of cropping to the simultaneous mode; which, wherever the soil is rich, is by far the most profitable.

The simultaneous mode of Cropping, is founded on the principles, that most plants, when germinating, and for some time afterwards, thrive best in the shade; and the tall-growing plants, which require to receive the light on each side, should be sown, or planted, at some distance from each other. Hence, tall-growing peas are sown in rows 10 feet or 12 feet apart; and between them are planted rows of the cabbage tribe; and, again, between these are sown rows of spinach, lettuce, or radishes, &c. Hence, also, beans are planted in the same rows with potatos or with cabbages, (an old practice in the cottage gardens of Scotland;) and so on. The great object in this kind of cropping is, to have crops on the ground, in different stages of growth; so that, the moment the soil and the surface are released from one crop, another may be in an advanced state, and ready, as it were, to supply its place. For this purpose, whenever one crop is removed, its place, ought to be instantly supplied by plants adapted for producing another crop of the proper nature to succeed it. For example, where rows of tall marrowfat peas have rows of broccoli between them, then, the moment the peas are removed, a trench for celery may be formed where each row of peas stood; and between the rows of broccoli, in the places where lettuces were produced early in the season, may be sown drills of winter spinach.

From the Farmer and Gardener.

CUBA TOBACCO IN MARYLAND

With regard to the growth of the *Cuba* variety of tobacco in this country, there can be no question. We recently enjoyed a cigar, the tobacco of which was grown in Dorchester county, Maryland, by that intelligent agriculturist, *Dr. Muse*,

who obtained the seed at Havana; which, for flavor was as fine as nine-tenths of the cigars imported direct from Havana. We say this without reserve, considering ourself a competent judge of the article.

From the New York Star.

THE NATIVE AMERICAN SILKWORM. NEW PLAN FOR THE WORMS TO WIND THE COCOONS.

Mr. Editor—Since the receipt of your paper yesterday, I received the Nantucket Inquirer of 15th inst., in which Mr. Jenks asks for further intelligence in relation to the articles on the silk worm, published in the Star of the 3d inst. As the words, "six different plants for the worm to wind the cocoon," were published verbatim as I expressed them in conversation with you, the call seems to require some explanation on my part. I will give it briefly thus: "It is so many contrivances to accomodate the insect in its preparation for "winding up," or so many different contrivances *on* which (not round which) the larvæ may suspend and wind the cocoon. One of the plans may be described thus: nine laths ¼ inch thick, 1¼ inch wide and 40 inches long, placed on edge, horizontal, parallel to each other, and 1 inch apart in the clear; these are connected by a lath, 11¼ inches long, fastened across the ends; the whole forming a grate of 9 bars 11¼ by 40 inches. Five of these grates, placed parallel to and above each other, ¾ inch apart in the clear, connected by a single nail at each corner, with a lath 9¼ inches long, standing vertically on end, forms *one plan*, which is probably the best of the six, and in the operation of some good judges is superior to all other plans (not excepting the European plan of bushes and branches of trees) for economy, both in the *space* which it occupies to accomodate an equal number of worms, and the *expense* of construction. The 46 laths required for its construction are worth 6 cents, and can be made with the labor of one hour, worth 12 cents—making in all 18 cents. The worm winds the cocoon between the bars and between the grates, when by removing the 4 vertical laths at the corners the cocoon can be cleared out in a few minutes, certainly in less time, and, in better condition, than the same number can be removed from among bushes and leaves.

The native American silk worm feeds on elder, which is its principal food, and from it spins a cocoon of good silk, strong, soft and lustrious, though coarser than that of the Asiatic worm; the smallest cocoon in my possession, from the native American worm, is 70 per cent. heavier than the heaviest of the Asiatic. A fair average of the native cocoons are nearly 300 per cent. heavier than most of the Asiatic. I weighed to-day a fair average of the native American cocoons with 4 different kinds of Asiatic, from my own raising this year—the weights show the quantity of silk, *without* the chrysalis, as follows.

Native American cocoon,	17 grains.
Asiatic large white cocoon,	6½ do
" bright white cocoon,	4 do
" Monti di Brianza, a pale yellow,	3 do
" Golden yellow,	2 do

The ova of the two last named, were imported by Mr. Tinelli the present year; they are much cultivated in Italy and Spain, and produce the finest silks in Europe. The Monti di Brianza is particularly famed for receiving and retaining the most beautiful dye. By the above you will perceive that the native American furnishes 850 per cent. more silk than the golden yellow Asiatic.

A description of the native American silk worm may enable Mr. Jenks to recognise an old and familiar acquaintance, which he has often frighted from its resting place with the exclamation "Oh! what a beautiful butterfly," pronounced in a tone too loud and too harsh for such sensitive antennæ.

It ranks in Linne's System of Nature in the Animal Kingdom, Class 5, Insects order III. Lepidoptera, Genus, Phalaena. The moth, or perfect insect, is without proboscis, and therefore cannot eat; it has antennæ 2 pectinate and black, head white, eyes 2 black, thorax red, abdomen entirely surrounded with alternate red and white, bands, wings 4 brownish gray, lighter in the male, interior of 2 upper wings red, with one large ocellate spot near each exterior, and 2 smaller and the distinct in the margin; from the anterior to the posterior is a band of 2 distinct white and red lines; between this band and the interior is a large white, lunate macula are the same in lower wings; across the exterior and margin is a band of 4 distinct lines, ashy gray, black, cream, and ashy gray; lower wings the same. The larvæ is greenish, without hair except a few on 2 protuberances, and feeds mostly on elder. The ova is cream color clouded with reddish gum, with which they are fastened to the lea or bark. The pupa or chrysalis is dark brown enclosed in a cocoon of strong, soft and lustrious silk. It is a native of the North American states, and is found in no other country. I have eleven of the cocoons in my possession, four of which I found on Manhattan Island, near Harlem, New York, and seven in the forest of Bergen county, N. J.

I intend this summer to manufacture some sewing silk from the native American cocoons, and hereby promise to send Mr. Jenks one skein of it provided he will "contrive" some better name than "*contrivance*" for the *plan* of lath described in this communication. Yours, &c.

C. F. DURANT.

Jersey city, July 21, 1837.

[We have for three years made attempts to investigate the habits of the insect described above, though with less success than Mr. Durant has met with. From the cocoons, found during winter on many kinds of bushes, it is easy to obtain the living moths—which came out (when kept in a cool house,) early in May, in this region. But, from the small number that we had, and the irregularity of their issuing forth, or some other cause, no impregnated eggs were obtained from the moths so confined. Once only, a female moth was caught that was already impregnated, and had commenced laying while at liberty. Her eggs soon hatched; but though the leaves of sundry trees were tried as food (the mulberry included) the young worms would eat none of them, and all perished. Mr. Durant has gotten over this difficulty, and may be able to rear enough worms to continue the race, and to furnish sufficient samples of their silk. As a mere curiosity

it deserves attention; but we are not sanguine as to any profit being obtained from the new fabric—from which much was confidently expected, as a source of national wealth more than a century ago, in Virginia, as appears from the curious old poem inserted in our first volume (page 734) on the "Virginia Silkworm."

The moth, or butterfly, which is the last form of this insect, is the largest winged insect known in this region. One of those in our possession last summer measured six and a half inches across from one extremity to the other of the wings, when laid horizontally. The outer coats of the cocoons are very strong, and so large, that some of ours were made by ingenious ladies into purses, which would hold each as much silver as was convenient to carry in a purse, and more than many of us now own, in this *paper* age.

Since the foregoing remarks were in type, we have seen that the publication of Mr. Durant has produced a somewhat angry controversy between him and Mr. Tinelli. The only thing gathered from it, at all material to other persons, is, that Mr. Tinelli declares the "native American silkworm" to be common in Europe, and that its silk is of no value, compared to that of the silkworms heretofore used.—Ed. Far. Reg.

From the Germantown Telegraph.

CORN—SUCKERS.

Some persons without understanding the natural history of the plant, at the last dressing, pull off the suckers, which is ruin to the crops, as they are absolutely necessary, not only to filling out the ends of most of the first years, but to filling out the late years to some degree.

The time in which the male blossom on the main stalk remains in vigor is not more than six days, when the season is good: but if the weather is hot and dry, or is very stormy, it is not so long. And this length is only enough to fructify the earliest ears in which the female blossom comes out first from the germ of the lowest grains, and present themselves in circles at the end of the corolla or husks, and as they come out, are impregnated, and thus they are every day and every hour presenting new circles of female blossoms, until the whole are thus impregnated. But if the heat is so excessive as to kill the male blossom before the whole of the female blossom has come out of the corrolla of husk, then if there are no suckers to supply the deficiency of pollen, there will be a portion of the upper end of the ear that will be barren of grain. To supply this deficiency of pollen, Providence, in organizing the corn plant, has ordered that the three lower joints should produce suckers that should come up in succession, to supply a continual source of the fructifying principle to the whole succession of ears that may come out for the space of at least three weeks, after that on the stalk has been exhausted. And on this succession of male blossoms, the greatness of the crop depends. And the land should be so rich as to force out at least two suckers on every stalk, or no very great crop should be expected. But if the land is so rich as to produce these, then instead of having the usual crop of about 35 bushels to the acre, the careful farmer may expect from 80 to 120 bushels with very little extraordinary expense, and this land will be prepared for other crops.

You will please to indulge me further to observe on the culture of corn, that to manure poor land in the hill is bad cultivation, although it is true that by this mode, the early growth of the corn is promoted; but the moment the roots of the plants extend beyond the manure, the growth of the crop is checked, at the most critical season, when the suckers and ears are setting, by which it often happens, that the stalk still runs up, and the male blossom comes out and is spent before the female blossom appears at all. But if the shovel full of manure that had been put in each hill, had been incorporated with the soil, the early growth of the crop would not have been so rapid, but then the growth would have been equal in all parts of the plant, and a crop would have been received in proportion to the goodness of the soil and preparation and attendance given it.

[The writer of the foregoing piece offers a new reason for the propriety of letting the suckers of corn remain on the stalks, viz: for the purpose of furnishing a later supply of fecundating pollen to the silks, or female flowers. But without attaching importance, or giving confidence to this opinion of the writer, we think his remarks worth notice in another respect, viz: that he seems to have no idea that any *diminution* of the quantity of grain is to be feared, from leaving the suckers, and does not either reply to, or even name that single objection to the practice, which operates on almost every cultivator in Virginia, and the more southern states. When, (in addition to the testimony of several correspondents of the Farmers Register,) so many northern farmers deny that any advantage is gained by suckering corn, and when it is known that the fields of extensive regions to the north are left without suckering, it ought at least to cause enough doubt to arise, as to induce farmers to test both practices, by fair comparative experiments. The suckering of corn, even if not hurtful, is certainly very troublesome on good land, and unless it is productive of a certain and not inconsiderable increase of crops, to avoid that labor, is a very considerable object.—Ed. Far. Reg.]

From the Inverness Courier.

EXPERIMENTS OF DIFFERENT MANURES ON TURNIPS.

For the information of turnip-growers, and to enable them to regulate their supplies of artificial manure in the ensuing season, we are authorised by Sir F. A. Mackensie to insert the following experiments, made on his Ross-shire farms in 1836. Having appropriated the greater part of his farmyard manure to the cultivation of newly reclaimed lands, Sir F. laid down one field of sixteen acres Scots, with bones, half drilled, half dust, dibbled in at about the rate of about twelve bushels per acre; the soil, a sandy loam, long cultivated, and one half of which had been limed four years previously. The whole produced a most luxuriant crop, but if any difference appeared, it was in favor of the part unlimed. Another field of fourteen acres had in part been reclaimed from heath about four years; the soil gravelly; the rest was old, light, earthy, croft land, in separate patches, the whole limed four years previously, and laid

down with bones dibbled at the same rate per acre; the crop was excellent, but on the old croft land superior to where it had been lately reclaimed. Both the above fields were sown with green top and Aberdeen yellow turnips. A third field, of sixteen acres, was laid down as follows:—five acres with Swedes, and best farm yard dung, as usually done; three acres with white globes, bone dust dibbled, sown at the same time as the Swedes (for early eating); four acres with best common farm yard dung, green tops, sown three weeks later than the globes; four acres green tops, in alternate patches of six drills each—first, dibbled bone dust; second, dibbled animalized carbon; and third, dibbled pulverised farm manure; the bones at the rate of twelve bushels per acre; the carbon nearly double that quantity; the prepared dung about a small handful to each dibble hole, and all sown in the same day. Soil of upper end of the field a good, dry loam; lower part poor, wet, cold, gravelly loam; the whole limed some years previously. Swedes a good crop, excepting a small part of the lower end of the field. Early globes, heavy crop upper, and good crop lower end. Green tops, farm-yard dung, poor crop generally. Bones excellent every where; carbon middling crop, and rather worse at lower end; pulverised dung excellent in upper end, very inferior in the lower. The difference was so marked, that even an inexperienced eye might perceive it, as each case was repeated three or four times, and the inference therefore is as follows. Carbon is not to be in any case recommended, excepting where the fly is destructive; in which case a small quantity might be advantageous, as for the first ten days it forces on the young plants in a surprising manner. Bones are most advisable as a general manure for all kinds of soil, and produce first rate crops of turnips, where they could not be grown by any other means. But if the soil be a good dry loam, there can be no necessity for the outlay upon an artificial substitute, when a pulverised manure can be prepared at home by any farmer, without any cost, and equally efficacious as the best bone dust. Sir F. likewise tried the carbon and bones on another farm, in alternate drills, on a small scale, on a light, poor, gravelly soil; and on a third farm in pure raw moss, all with the same results. The carbon for the first fortnight appeared by far the most promising; but in November the crop from bones was double the weight of the other. His pulverised farm-yard manure is formed from weeds completely rotted by repeated turning and fermentation, and then saturated with liquid from the folds, collected and carried in drains for that purpose into a covered tank, where it is kept till wanted—to this is added some old trenched manure, the whole well pulverised by repeated turning.

From the Maine Farmer.

WINTER WHEAT.

Mr. Holmes:—In the Maine Farmer, of the 30th May, there is a valuable communication from Mr. James Ronaldson, on the culture of winter wheat.

It is a subject of the first importance to the farmers of this state; and every individual farmer who is anxious to raise bread for our own consumption, ought to feel it a duty to make limited, or extensive experiments, according to his ability, for the purpose of testing the value of Mr. Ronaldson's suggestions, and whether they will suit our soil and climate. It is also the duty of those who have already made experiments, in any way connected with the mode proposed by Mr. Ronaldson, to disclose the same.

Mr. C. Fairbanks' communication on the subject is useful and encouraging; and under this impression, I shall state what course I have pursued, and my reasons for the same, and then offer a few remarks on the proposed plan.

From my early acquaintance with English husbandry, I gave the preference to winter wheat, and imported, in the year 1788, a few bushels from Liverpool, of the '*White Lancashire Winter Wheat,*' which succeeded very well, and from this wheat 54 barrels of good flour was manufactured at a flour mill in Hallowell, in 1794, and shipped for sale to Boston. Twelve years after the importation, a bushel of this wheat was sown in the town of Corinth, county of Penobscot, by Henry Snow, on an acre and a quarter of burnt land and produced forty bushels of prime wheat. I brought four quarts of it home, and from its produce, continued for a few years to sow it on ploughed land. I think about ten years after, I procured from Connecticut, a superior quality of winter wheat, called the Taylor wheat, which was first raised in Virginia, by a gentleman of that name. This kind I have continued to cultivate, and from this, or my imported wheat, I obtained from one bushel, ground at the mill at Gardiner, 52½ lbs. of good flour, including the toll. The average yield has been thirteen to fourteen bushels to the acre, which I considered equal to seventeen or eighteen bushels of spring wheat, with the advantage of preparing the land, and sowing the winter wheat at the season of greatest leisure.

Being satisfied that even in ploughed land, where the soil and make of the land was favorable, winter wheat was preferable, I tried the following experiments:

1. I sowed in drills in my garden, in the *spring*, some winter wheat, and during the season, until September, frequently cut it down. A smaller proportion was winter-killed, than in the open field.

2. In the second experiment, the wheat was sown after a crop of oats. With the oats I sowed twelve pounds of clover seed. When the oats were nearly ripe enough to reap, the grass-hoppers made such havoc by cutting off the grain, that the ground was strewed with seed. The oats were immediately reaped, the clover and stubble ploughed in, and about the middle of August, the winter wheat was sowed. In a short time, the verdure was remarkable, and on examination, I found that the oats which had been in and on the ground, had sprung up and covered it. Aware that the winter would kill the oats sown at this time, the effect on the wheat was carefully watched, and the oats proved a protection to the wheat in winter, and with a dressing of a bushel of plaster of Paris strewed on an acre in the spring, served as a top-dressing. The wheat grew vigorously, and there was an increase of produce from it. Since that time I have always sowed a bushel and a half of oats to the acre, with the wheat, and spread a cask and a half of lime on the same quantity of land.

3. A third experiment was in clearing up six acres of a bush pasture. No grass seed had been sown, and what grass was on the land was from seed dropped by the cattle fed on it. It was ploughed deep in the fall, in the spring harrowed, cross-ploughed, and harrowed again, until it was mellow. For two years, oats were sown with 12 pounds of red clover seed, and ploughed in, after reaping the crops of oats; and in August, after the second crop, winter wheat was sown. The soil was a rich loam, and the form of the land was in moderate *swells*. Owing to this, the crop was uneven, as the snow drifted deep in some places and in others the land was bare. The wheat was vigorous, 5 feet 4 in. in height, and the ears over five inches long. The crop was a profitable one, and for three years after, the land produced as much grass as could be dried on the ground.

4. My last experiment was sowing in the spring a small piece of land with winter wheat. It lay next to the sheep pasture, and was occasionally fed by the sheep until September. This experiment did not answer, probably from the want of previous cultivation, and the snow not covering it during the winter.

As regards Mr. Ronaldson's proposals of sowing the winter wheat, so early as to raise a crop of barley on the same land as the winter wheat, there is the following objection. Whatever crop is raised that produces seed, and quantity sufficient to repay the labor, must exhaust the ground, and in this case the barley will take from the wheat a portion of the nourishment intended for it. For this reason, will it not be better to sow oats or barley for a crop early in the spring, with 12 lbs. of red clover seed, and as soon as this grain is reaped, immediately to plough in the clover and stubble, and sow the winter wheat with the oats as proposed before? The growth of the clover by this mode will replace what the crop of oats or barley has taken to manure it.

This subject is a very important one, and if by experiments we can secure a mode of cultivating winter wheat on ploughed land, that would be profitable, it may be the means of increasing the quantity of wheat raised, as well as improving the quality.

It is a fact that winter wheat is a sure crop on new land, where the growth has been cut down, and recently burnt off. In the state of Maine, a great quantity of new land is annually brought into cultivation, and the use of winter wheat as the crop, will have other advantages besides its increased value. The farmer by this means will have the whole of the season from the spring until the first of August, (and on burnt land a later period will answer to sow the wheat) to burn and clear his land, without interrupting his labor on his spring crops, and will not depend on favorable weather to burn off the trees for spring grain.

CHARLES VAUGHAN.

June 19, 1837.

[The reader of the foregoing piece should bear in mind the great difficulty and uncertainty of raising wheat in Maine, which have operated so strongly on most farmers, as almost to stop the culture, and on others to seek relief in the substitution of spring wheat and other inefficient remedies. The legislature has entered upon the field of controversy, and by the offer of a bounty on every bushel raised, expect to bear down the existing obstacles to wheat culture in Maine. This bounty, (on the policy of which we commented at page 692 vol. IV.,) it is said, will have the effect of increasing enormously the crops of wheat raised in Maine—but will not remove or lessen the true and great obstacle, (the want of lime in the soil,) and the increase will probably be purchased at a dear rate by the treasury bounty. Let the legislature of Maine induce (whether by bounties, instruction, or otherwise,) the application of calcareous manures on the lands now so deficient in that necessary ingredient, and their thence newly acquired fitness for wheat will cause the culture and success of that crop, without a direct legislative bounty for its production. In the last paragraph of the foregoing letter, there is a striking confirmation of our opinion on this subject, (which we have stated more at length before, in the remarks referred to above,) in the fact that *newly cleared woodlands, on which the wood has been burnt, produce wheat with great certainty.* Now the only cause of this, is that the ashes of the trees supply the land for one year, with a sufficiency of carbonate and phosphate of lime to be taken up by the wheat, and which ingredients, in unusually large proportions, are essential to the healthy existence of that crop. If the intelligent and public-spirited editor of the *Maine Farmer* will exert his influence to have the trial of calcareous manures fairly and fully made on proper soils in Maine, we will hazard any reputation that we may possibly possess, by the prediction that the alledged obstacles to that culture, of climate &c. will then be found no longer to be very important.—Ed. Far. Reg.

From the Charleston Courier.

THE GREAT SUBMARINE SPRING DISCOVERED OFF THE COAST OF FLORIDA.

To the Editors of the Courier:

Charleston June 23*d*, 1837.

Gentlemen: The phenomenon, on the coast of Florida, as described by captains Sisson, Pettigrew, and others, in your paper of this morning, is not new, though the mineral properties of the water are certainly so. The spring off St. Anastasia island, south of St. Augustine, has been long known to navigators, and I have heard of those who have profited from it, in obtaining a supply of fresh water. The doubts which prevail, as to its existence, may be traced to the fact that it intermits, and, at certain seasons, "no agitated sea, like a shoal," is to be discovered in that quarter, Its appearance changes with circumstances—the surface sometimes larger or smaller, and more or less agitated, according to the greater or less quantity of water evolved. These marine springs are not uncommon along the coast of Florida. In addition to those mentioned in your paper, there is a very imposing one in the latitude of Jupiter inlet, and being immediately off a point of rocks projecting into the sea, it has not unfrequently caused much uneasiness to navigators who have unexpectedly encountered it. This I have seen in its most an-

gry state of ebullition, and but for the discoloring of the water, changing from the deep green of the sea to the muddy mixture of the interior rivers, it would have been difficult to have ascribed the agitated state of the ocean to any other cause than the rocky projections and shoals so visible in that latitude. The origin of these springs has been a subject of some speculations to the writer of this article: The cause seems simple; explaining at once their existence, as well as their occasional intermission: The eastern section, indeed, the interior of eastern Florida, generally, with the exception of some spurs, or projecting high lands on the western boundary, as low down as the bay of Tampa, is exceedingly depressed. Its surface is elevated but a very few feet, if any, above the higest water of the tides. Indeed, in speculating, in my wanderings, on the origin of that portion of the territory, I have thought that the whole region was at one time a bank, similar to the Bathama, submerged in the deep, spotted with sand, coral, and madrepore keys, and which have either been elevated by the sands thrown on its surface from the innumerable currents and counter-currents coming in conflict in that quarter, or from the ocean itself receding. Once dry, and acquiring a growth of marsh, grass, weeds, and brush wood, in succession, its elevation in the interior has been annually increased; while the winds prevailing for many months from the same quarter on the sea shore, sea sand ridges, and of singular regular formation, (more like the parapets of a fort, shaped with the eye of an engineer,) have been formed, presenting barriers to the encroachments of the ocean. It is easy to conceive that a country thus formed, hollow in the interior, like a basin, and the receptacle, at certain seasons of the year, of the waters of nearly three months' incessant rain, must find some vent for these inundations. The first is by the hollows, or more depressed spots in the country, which are the lakes, for which Florida is remarkable, the beds of which, being lower than the levle of the sea, always retain their waters at that level, parting with the surplus only, which rises above.

The second is by the rivers formed by these accumulated floods, and which, in contributing their supply, force their way through the sand hills to the great reservoir—the ocean. It is a subject for interesting, if not instructive speculation, to witness the war waged between the *waters* of these rivers, and the *winds* and the *waves*, and the *sands of the sea*, struggling to obstruct them. In the seasons of the mighty flood, the rivers become stronger, and *force* and *deepen* their way into the ocean, the flood subsiding: the unwearied surf which beats with the eastern breeze on that coast; the winds blowing for nearly six months, and almost uniformly from the same quarter, and the moveable sand heaps under their control, again conspire, and close up the channel ways, which the rivers, now too week to resist, are compelled to submit to. In some instances the ocean coalition have completely triumphed. Jupiter inlet, though at one time admitting of a depth of 7 or 8 feet water, has been entirely closed, and the accumulated waters of that river have been forced to form a junction with the Indian, creating, in all its characteristics, another St. John's; draining the southern everglades, and coursing parallel with the ocean for many miles, before it mingles, in a higher northern latitude, its waters with it. Further south, the bar of the *Rio Seco* (which means *Dry River*) has likewise been closed, and forced to discharge into a chain of lakes, which, if not already united, will one day find an outlet by New river, which, running south, mouths about twenty miles north of the Cape. The contest waging in this quarter, between the sea and the river, is destined, at no distant day, to force that river to seek a protection under the lee of Key Biscayne. Its present mouth is now six miles south of what it was ten years ago, when visited by the undersigned. In a country so peculiar, and based, as it is, in many parts on calcareous and porous rocks, and madrepore formations, in addition to its surface drainings, it must often use subterraneous canals for discharging its suddenly accutmulated waters. Florida is not only remarkable for these subterranean streams, but, in many instances, her visible rivers disappear, and prefer a concealed channel for the venting of their waters. These phenomena would seem to explain, and in a very simple manner, those marine springs seen on the coast of Florida. As the floods descend, and the waters in the basin become more elevated than those on the ocean, they begin to discharge by all the outlets afforded by nature. Where surface rivers fail, the subterraneous passages are substituted and if we were to examine we would probably find that at all the points in the sea where these springs have been discovered, the basis of the country adjacent was either rock or madrepore formation. I know this to be the fact in relation to the spring off Jupiter inlet—and that described by Captain Sisson is abreast of St. Anastasia island, the whole base of which is of that shelly formation of which the fort and principal buildings of St. Augustine are constructed. Whether the waters, in passing through the subterranean caverns of rocks, imbibe mineral properties, or whether the mineral springs themselves, of which Florida abounds, of sufficient elevation at their sourse, thus find a subterraneous connexion with, and pour their overflowings into the sea, are facts, if beyond our ken, very simply explained by most plausible conjectures. That these springs exist—that they appear and disappear, with the rise and the fall of the springs and floods of the interior, are facts notorious to many. Whether the solution of the origin and intermission are satisfactory, is for those to speculate on who are fond of looking into and tracing the causes of the supposed phenomena in the natural world.

Respectfully, yours,
JAMES GADSDEN.

From the Cultivator.

THE GRAIN WORM.

We are sorry to learn, has committed great ravages upon the wheat crop, and extended itself, as we predicted, into Dutchess county, on the south, as far as Fishkill; and there are reasons to believe, that it may be found west, nearly or quite to the Genesee valley. In a circle of 20 miles around this city, it is estimated, that the product of the wheat crop will be diminished two-thirds by them; and we are told that in some cases the wheat fields have been opened to the farm stock, not being considered worth preserving. The worm is also

found in rye and barley. Some spring wheat was sown by us in May, in the hope of escaping the worm. It is now (July 16,) coming into head. The fly of the grain worm is seen upon it at evening, in small numbers. We shall note its effects in our next number.

We would here call the public mind to the fact, that three years ago, while the worm was yet but on our borders, the State Agricultural Society pointed out, in a memorial to the legislature, the apprehended evil, and urged the policy of offering very liberal premiums for the discovery of an efficient preventive; but their suggestions were not even courteously noticed. Such premiums might not have done good—but they could not possibly have done harm; and had they led to the discovery of a preventive of the evil, such a discovery would have benefited the state millions of dollars.

From the British Husbandry.

MANAGEMENT OF CLAY FARMS.

Beatson's System.

Knowle Farm, in the neighborhood of Tunbridge Wells, which was a few years ago, in the occupation of the late Gen. Beatson, contains about 300 acres of land, of which 112 are arable, and is described as abounding with clay, and retentive of surface moisture, but when dried by the summer heat, it becomes as hard as a brick, and impervious to the plough, unless with a great power of animal exertion, particularly as the general mode is to plough deep. The established rotation in that part of Kent, and the neighboring portion of Sussex, is fallow, wheat, and oats, with occasionally clover and rye-grass; and the husbandry appears to have remained unaltered for many ages, with the single exception of substituting lime for manure instead of marl. Upon this system the farm was managed during the General's absence, while governor of the Island of St. Helena; and finding on his return, in the year 1813, "that he had no cause to boast of its profit, he resolved to trace the whole progress of the operations, from the commencement of the fallow to the close of the rotation;" the result of which was, that "having made a series of experiments, to which he devoted his attention during five years, he determined upon the *total abolition of fallows.*"*

In order to effect this, he adopted several new implements, chiefly of his own invention, for a description of which we must refer to his "New system of cultivation," as we have only seen the scarifier in use. This is of a light construction, and certainly performs well; though upon land such as that described by the General, it is worked by a pair of horses, and sometimes more, instead of one.

He conceived that the grand scource of all the heavy expenses of the old method might be traced to the fallow itself, and to the mode of preparing it—" by bringing up immense slags with the plough, by reversing the soil, and thus burying the seeds of weeds that had fallen on the surface, by which a foundation is laid for all the subsequent laborious and expensive operations. To avoid these, he, therefore, thought it necessary to proceed in a different manner—"to only break and crumble the surface soil, to the depth that may be required; to burn and destroy the weeds; after which he would have the land in a fine and clean state of pulverization, and in readiness for receiving the seed, without losing a year's rent and taxes; and all this at a mere trifle of expense, when compared with that which is incurred by a fallow."

In pursuance of this, he reduced the ploughing to a single operation at the depth of four inches. The chief use, indeed, which he made of the plough was to open furrows at twenty-seven inches apart, which was performed by a couple of horses at the rate of three acres per day, and was merely intended to prepare the land for the scarifiers, "which, by passing twice across these furrows, loosen all the stubble and roots of weeds, which are afterwards, with a small portion of the soil, placed in heaps and burned." By these means, together with the more frequent repetition of the horse horse-hoeing, and the introduction of the row-culture, the General assures us "that his lands were rendered much cleaner, and yielded better crops than they did formerly, after all the heavy expenses of lime and fallows." *—He indeed, states, that these operations produced the effect of pulverization to the depth of six or seven inches, and their expense was—

	s.	d.
Five scarifyings, with a single horse implement, at 1s. 8d. per acre. -	8	4
Two harrowing, at 10½d. - - -	1	9
	10	1;

that the whole charge of cultivation, under a four-

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* His experiments were extended to various objects besides the working of the land; particularly to the combinations of different kinds of manure, and the burning of clay, (for which, see our vol. i. chap. 16, 17;) but our present extracts only extend to the subject of fallowing, the charges of which he states to have amounted to £16 per acre, thus:—

	£	s.	d.
Labor, breaking up the clover ley and three subsequent ploughings. -	3	12	6
Eleven harrowings at ten acres per day,	0	9	0
Manure, one and a half wagon loads of lime, between the third and fourth ploughings, - - - - - -	7	10	0
Carting and spreading do. - - -	0	6	0
Seed, two and a half bushels of wheat 10s. - - - - - - -	1	5	0
Sowing and rolling, - - - - -	0	1	6
Rent and taxes for the year of fallow,	1	10	0
Ditto for the year of crop, - - -	1	10	0
	£16	4	0

* On this subject he also observes, that "those who plough deep, and bury the seeds of weeds by the first ploughing, are not aware that, by this outset of their fallow, they lay the foundation of a great deal of labor and mischief, and bring upon themselves the absolute necessity of a fallow, as the only means of eradicating the progeny of those seeds, which they have inadvertently deposited deep in the soil. Now, if the whole of the stubble and its roots, with a small portion of the surface soil, *which contain those seeds*, be collected and destroyed by fire, it is reasonable to suppose that lands might be as effectually cleared of weeds in this manner, as by a summer fallow; besides they would have the benefit of a considerable portion of ashes. Perhaps, also, this mode of burning might have a tendency to prevent the disorders of smut and blight; disorders with which my crops have not been in the smallest degree affected."—2d Edition, p. 90.

course system upon this plan, including rent was—

	£	s.	d.
Tares, beans, peas, &c. per acre, -	5	0	0
Wheat, - - - " -	5	0	0
Oats and barley, - " -	3	13	6
Clover and rye-grass, " -	2	15	9
	£16	8	6

thus only amounting to a trifle more than that of the fallow upon the former plan; that land cultivated upon his farm in this manner has yielded 460 sheaves of wheat per acre, whilst the average produce of the other fields did not exceed 360; and that the *difference in favor of the new method amounts, upon an average*—when wheat is at 10s. the bushel— to £350 per annum upon the cultivation of 100 acres.

From the Genesee Farmer.

SUMMER FALLOWS—EFFECT OF FREQUENT PLOUGHING.

The effect which frequent ploughing has on land intended for summer fallows, or on which wheat is to be sown, has in some degree attracted the attention of farmers, but further observation, and a comparison of the results, are still desirable in order to a berfect understanding of the matter. If the crop of wheat will be no better for five or six ploughings, it is certainly desirable to save the labor; and if it should appear that the crop, and the soil, too, is injured by too much ploughing, and that ploughing thoroughly once is better than to move the ground deeply with the plough as many as four or five times, then farmers should understand the matter, and husband their time and labor accordingly. Our remarks will principally relate to land in good tilth, and which is ploughed for the benefit of the crop alone; lands infested with noxious weeds, such as thistle and Johnswort, may be ploughed as often as these weeds show themselves in the season, and this is the most effective method of destroying them; but we have serious doubts whether land so ploughed would produce as good wheat as if ploughed not more than once or twice.

Much of the soil of west New York is composed on the surface of what may be called calcareous loam, based more or less on earth containing large quantities of clay, the latter frequently running into clay slate, or, where the lime predominates, into limestone. The soils that abound in clay and lime, furnish the best wheat lands of the state, and the surface after ploughing soon assumes the dark hue, indicative of soils impregnated with the salts furnished by vegetable decomposition. In this surface-soil is found the favorite food of plants, and the question arises, whether frequently turning the soil deeply, so as to prevent the combination at the surface so apparently necessary to the growth of the plant, would not be a positive injury rather than a benefit? Deep ploughing is necessary to loosen the earth, and render it permeable, to a proper depth, for the roots of the plants put npon it; it is only when new soil from a considerable depth is so frequently brought to the surface that the ameliorating effects of the sun, air, and fermenting gases, have no time to exercise their influence, that the surface becomes unfit for the purposes of vegetation.

It has been remarked by one of the most scientific and able farmers of the present day, Judge Buel, "that unfermented vegetable and animal matters, including greensward, green crops and long manure, after being buried by the plough, should never be exposed to the sun and winds by cross ploughing, until they have become perfectly rotten. The gaseous matters which dung gives off while undergoing fermentation, always rise, because they are lighter than the atmospheric air. They enrich the soil and afford food for plants, because they have already formed the necessary parts of plants. Hence, if fermentation takes place *on* the surface, these gaseous matters are scattered and lost; if *in* the soil, the earths and moisture retain them there, and the plants feed upon them." This union of the fertilizing gases takes place at the surface of the earth, and if this fertile stratum is too frequently displaced, the surface will in a considerable degree be rendered barren.

Mr. Thomas J. Randolph, in an able paper published in the Farmer's Register, says, in speaking of the propriety of frequent ploughing for fallows—"when good land, (particularly clover land,) with a distinctly marked surface of dark soil, is fallowed for wheat, sown with the harrow upon one ploughing, and permitted to lie a year or two in clover, after the crop of wheat, the dark soil that was turned under is again formed upon the surface, occupying the position in which the clay was left by the previous ploughing, and the clay, that which was occupied by the inverted soil. * * * I suppose this change is accomplished by the gases evolved in the decomposition of the vegetable matter turned under by the plough. If the weather is warm, and the vegetation green, succulent, and abundant, the decomposition is rapid, and the quantity of gas disengaged is great. Of these, the carbonic is deemed the great stimulant of vegetable life; and being heavier than the atmospheric air, but lighter than the soil, it rises to the surface, insinuating itself into the interstices of the clay brought up by the plough, saturates it, and accomplishes the first process of its conversion into soil. Hence the cause of a well known fact, that fallows made in June, or July, become many shades darker on the surface, although exposed to the scorching rays of a summer's sun, than those made in September and October, when the days are shorter, vegetation drier and less succulent, the nights longer and cooler, and every circumstance less favorable to a rapid decomposition."

Perhaps the most thorough and frequent ploughings known among us, are given to those summer fallows where the destruction of the Canada thistle forms an important object in the culture of the field. Fields have been thus ploughed from six to ten times, and we believe it has been almost uniformly found, that while the certainty of destroying the thistles increased in proportion to the frequency of the ploughing, the chance of a succeeding crop of wheat was diminished in the same degree. The observation and experience of almost every farmer must have furnished instances where repeated ploughings, caused the failure of a crop, or at least greatly lessened its value. Where so important an end is to be attained as the destruction of the thistle, the loss, partially or wholly, of the succeeding crop, is of little moment; the end may be pursued without regard to collateral consequences, as rest and manure will at once remedy the

evil. A few years since, a gentleman in one of the central counties of this state, treated a large field, overrun with thistles, but strong rich land, in the way described above. It was ploughed early, and as often as any thing green showed itself on the surface; the number of times we do not now recollect. The time for sowing came, and the field was pronounced in capital order; no vegetation of any kind to be seen; the soil finely pulverized, but bearing too much the cast of the clayey substratum; and the farmer flattered himself that he had not only killed his thistles, but secured a fine crop of wheat. Spring came, and if the thistles came not, so neither did the wheat, and to the great surprise of all, his field remained nearly bare at harvest The soil appeared to be deprived of the principles that promote vegetation, and to have become dead and inert. Others have witnessed similar results.

We should infer from the foregoing opinions and experiments—Firstly, that where necessary to plough deep, in order to give a free range to the roots of plants, it should be performed thoroughly, and not frequently repeated. Secondly—that early fallowing is decidedly preferable to a ploughing that is later, as it gives the surface time to regain from the ascending gases and action of the atmosphere, the fertilizing principles, of which the lower stratum of soil is destitute. Thirdly—that when green crops, such as clover, or buckwheat, are turned under, they should not be disturbed until decomposition is complete, and their valuable properties thoroughly incorporated with the soil; and fourthly—that since nature in all cases, where left to perform her operations undisturbed, prepares the surface for the reception of seed, farmers should profit by her labors, and not, unless rendered necessary for other purposes, counteract her preparative measures, by unnecessarily changing the surface in frequent ploughings.

NOTES OF A THREE-DAYS EXCURSION INTO GOOCHLAND, CHESTERFIELD, AND POWHATAN.

By the Editor.

VISIT TO "GRAHAM'S COAL PITS."

While in the neighborhood of the coal mines, I was desirous of descending into, and examing one of them; and my choice was directed to "Graham's Pits," partly by vicinity, and convenience, and still more by the advantage of the company of my old friend Edward Anderson, esq., who is one of the present owners.

The former owner, Graham, a rich old Scotchman, seemed to have had a greater passion for opening new shafts, than resolution and perseverance to exhaust the coal to which each opened. The land is blackened and defaced throughout by the sites of numerous old shafts, and the heaps of slate and remains of refuse coal, which form naked and barren spots forever after. These shafts (or perpendicular pits, through which the coal is lifted,) were sometimes within fifty or sixty yards of each other—and at any rate were very far more numerous than was necessary, even if they had been fully worked. But it has since appeared, that from no one shaft was half the coal raised, that might have been, by the means now used—and from many, very little was got out. It seems indeed, as if he dug shafts merely to ascertain the extent and state of the coal bed, and in many cases partially filled and abandoned them, as soon as the coal was penetrated.

I heard several remarkable cases of the ignorance that have sometimes existed in regard to what is beneath the surface of the earth, among persons above, in the immediate neighborhood; and here was one of the most remarkable. When the tract of land was about to be sold, after Graham's death, it was supposed that all these abandoned shafts indicated either exhausted workings, or "seams" of coal not worth working. Graham's mining operations had been superintended and directed entirely by a confidential slave of his own, (whom he afterwards emancipated, and then paid $200 a year wages,) and the laborers were also slaves; and they, only, knew any thing of the condition of the coal. A gentleman who resided then, and still is, within two miles of the works, and who is an intelligent and judicious business-man, (and who stated to me these circumstances,) was desirous of joining in the purchase of the property; and was authorized by two capitalists to buy it for them and himself, at $40,000, if necessary, provided he could obtain satisfactory accounts of the quantity of coal. The works were then suspended; but all information, from what seemed the best authority, seemed so well to establish that the coal was nearly exhausted, that he felt no longer any inclination to buy, at any price; and the whole tract, of about 1,000 acres, and through which the coal has been reached by shafts for more than a mile of distance, near the line of out-croppings, was sold for $13,000. The operations since, though far from being well conducted, and indeed attended by some causes of heavy loss, have at least shown that the coal is abundant.

A steam engine of ten-horse power is in operation at one of the shafts, drawing off the water accumulated in the old works. Two enormous buckets, each holding 170 gallons, are continually bringing up the water—and the artificial stream thereby formed, which is running continually to the river, and with a pretty equal volume after reaching some distance below, is large enough to turn a mill. The depth of this old shaft is 360 feet, and the water is still 160 feet deep, and will require yet a long time to be drawn off, by the means now in operation.

Two other neighboring shafts are now worked, the depth of neither exceeding 200 feet. The coal is dragged out of the "drifts" or working galleries in "corves," which hold from three to three and a half heaped bushels of coal. These corves are like little sleds, sliding on runners shod with iron. Each loaded corve is attached, at the bottom of the shaft, by hooks to one end of the rope, in place of the empty one sent down, and is rapidly drawn up by two mules, while another emptied corve descends at the other end of the rope. The mules move very rapidly in a circle, to work the drawing machinery, and are turned in the contrary direction at every ascent of a bucket, to reverse the movement of the ropes.

Before descending, we had first to take the usual and very necessary precaution of changing our outer clothing for old jackets, trousers, shoes and hats, (kept for the purpose,) of a quality and fashion not to be hurt by any such exposure. This

masquerade dress was not a little ludicrous—but it is so frequently resorted to here, that it is quite a thing of course, and attracts no notice. We had not to be let down the shaft in an empty corve, as is the usual course, (and which I have tried elsewhere, on a former occasion,) as there is a steep sloping tunnel cut for a foot-way. The entrance is through a low and rough door-way, supported, as are the ceiling and sides of the tunnel, by "gearing," or timbers placed thickly for that purpose. The descent through the foot-way was at an angle of about thirty degrees, and is rendered not a little fatiguing by the stooping posture, made necessary by the low ceiling. However, a larger and better graduated foot-way is now constructing, which will make the passage sufficiently easy. Each of us carried a miner's lamp, and all our lights served to dispel the deep darkness but for a few feet around us. After descending some distance, we came to a hole through which we had to let ourselves down about four feet into a lower passage. When we got to the coal, the gallery through which we passed was similar to the upper part of the foot-way, except being generally higher, rarely requiring one to stoop, in walking through.

The bed of coal is every where steeply inclined, or "dips" rapidly. The dip here is about thirty degrees, and in other mines it is often much more. Of course, from wherever a new shaft reaches the coal, drifts may be dug, according to their direction, either ascending, descending, or horizontal. The plan is to make the first or main drift ascending, or following the greatest ascent of the seam, and to pursue it to the extremity (or out-cropping) of the coal, unless it be so distant that it would be cheaper to dig another shaft. After this main gallery is finished as far as is desired, a drift is carried across it, and near to the shaft, on a level bottom, or nearly so; and others are opened, in succession, similar and parallel to the first cross-drift, and about twenty to forty feet apart from each other. Each successive cross-drift is of course on a higher elevation than the preceding, and all discharge into the first main drift, which serves as the passage from all to the shaft. Afterwards, other drifts are carried parallel to this main passage, and of course, cutting nearly at right angles all the first parallel drifts. When all these galleries are finished as far as the workings are designed to extend, for one shaft, the whole seam of coal through that space is divided into square masses, or "pillars," of twenty to forty feet diameter, and the perpendicular height of the seam of coal.

The drifts are dug from three to five feet wide. When the miner has dug in about two feet, (a little more or less, it may be, according to the degree of the solidity of the roof,) and the side walls have been made perpendicular, he puts up on each side a prop of green timber, five to eight inches through, with a cross timber extending from over the top of one to the other—and so shaped at the joinings, that the cross-piece cannot possibly be made to slip off, by the enormous perpendicular pressure. These two uprights and one cross piece, when placed thus, and similar ones at every two feet, or thereabouts, form the frame-work of the gearing. Rived timbers about two inches thick are placed over the cross timbers, and close enough together to prevent any falling in of loose rock from above. These split pieces of course are across the cross-timbers or joist-pieces, and therefore run in the same direction as the drift. Other similar split pieces are also soon required behind the upright side-timbers, as the coal, however solid at first, soon begins to moulder and crumble down, therefore requiring to be in some measure kept up by timbers. This plan of gearing would seem sufficiently laborious and costly, even if permanent; but it is continually failing, and the timber of every drift requires renewal about once a year—and this not so much on account of rotting, as of the crushing and sinking of the timbers. As we groped along the drifts, I noticed one of the uprights bent to an angle, and splintered, in yielding to the pressure; and remarked to the overseer, who acted as our guide, that his timber there was too small. He answered, as coolly as if we were in day light, "No, it is only the creeping of the metals above our heads." I soon saw plenty of such cases of shivered and yielding timbers, and was surprised to learn that it was not a partial and particular effect, but a general and continued, though usually very slow and gradual sinking of the roof, or "creeping" down, as they call it. The side-walls of coal crumble, and run out more or less into the galleries, or otherwise press the props inward. To prevent these being bent or broken inward, lower cross pieces (called "Sampsons") are put between them, to resist the pressure from the sides. But if nothing else gives way, the bottoms of the props gradually break into the foundation of coal or slate below, and sink lower than their original position, and thereby suffer all the gearing, and the roof, to come lower. So it is, however, the roof of a mine that is worked to its full height, and to enough extent, is continually "creeping" down, and generally "tumbles" or falls to the floor, before near all the coal has been removed.

But before any considerable and extensive sinking has taken place, new galleries and enlarged diggings have rendered most of the first diggings useless. After making drifts as above mentioned through the space intended to be excavated, the masses of coal left are "robbed," or reduced in size, throughout, and then are again so reduced a second time. Finally, if not prevented by a previous "tumble" of the superincumbent slate-rock, the whole of the coal, or as nearly the whole as may be, is removed, by beginning at the extreme limit of the working, and then coming on towards the shaft, leaving the roof with no additional timber support; and it unusually falls in very soon after the space is emptied and abandoned. In such cases of final operations, a coal mine must present an unusually exciting scene; there being added to the usual matters of interest, the increased apprehension of danger—the rapidity of the excavation, by the concentration of numbers in small space—and successive abandonment of each portion—and by the continual sounds of cracking and crushing timbers, and falling in of masses of the stony roof, in places not many yards distant, and which were excavated by the miners but a few days, or perhaps but a few hours before.

The water, that is always met with in digging coal, if in a new work, is made to drain into a deep pit, under the shaft, whence it is drawn up in buckets, when enough is collected, by the same machinery that draws the coal. In some pits, it is so abundant that the drawing of water and of

coal is necessarily carried on together, that is. first a vessel of water, and then one of coal. But if there is an older and deeper mine close by, which has been abandoned, the water is easily led there, and thence drawn up, when necessary, by separate machinery, as is done here.

In going through the galleries, we passed different places where miners were "drifting," or digging galleries, and gearing them, to supply the corves which the "trainers" drew off to the shaft. The dragging of the loaded corves seemed to be heavy and oppressive labor. Each man, has a chain fastened by straps around his breast, which he hooks to the corve, and thus harnessed, and in a stooping posture, he drags his heavy load over the floor of rock. Every digger and trainer has his lamp—and their appearance well accords with the gloomy scene of their labors. However, the task may be light enough, though the operations are laborious; and so it would seem, from the fact that the laborers are permitted to do extra work for their own gain, and that they do earn money in that manner. I even saw afterwards where they had opened two (not very deep,) shafts to the coal, for their own private working—though their proceedings had been stopped, and certainly should not have been permitted to be commenced, on so distinct and independent a footing.

At one part of a gallery the carbonic acid gas was so strong that two of our lamps were extinguished, and the third, carried by the guide, was kept burning only by his holding it as high as possible. I had supposed, before, that wherever lights would not burn, the respiration must be powerfully affected, and life endangered, by exposure of any length of time; but was surprised to hear that digging was sometimes executed in spots in which no flame could live an instant. But though laborers are not very sensibly affected by a certain degree of exposure, if they continue there long, they become very sick when they reach and breathe fresh air. Finding that the effects were not so powerful and dangerous as I had before supposed, I requested to be carried to where the gas was still stronger. It was generated in an old working of the lower seam, which communicated by some fissure with the lowest drift of this seam, and the working of which had been suspended on that account. I followed the guide to the lowest part of this descending drift. Our lamps, though nursed as carefully as possible, for experiment, went out when we had not reached the bottom by some seven or eight yards of distance. Still at the lowest point, and even when stooping so as to breathe with two feet of the floor, I did not perceive the peculiar smell of carbonic acid gas, nor was I sensible of any inconvenience, after remaining several minutes, except a slight sense of fulness in the head.

As this gas is continually extricated or generated in coal mines, and its great weight prevents its ascending, in still atmospheric air, its accumulation would make any mine unfit to live in, but for the ventilation which is produced by currents of air, directed at will through the galleries. By this means this gas is stirred up, and diluted by mixture of other air, and by throwing it into the ascending current, is continually thrown out of the mine.

A much more dangerous gas, hydrogen, or inflammable air, is evolved in some places, and in some mines in large quantities. This comes in through crannies and fissures in the coal, and metal pipes are fixed for it to pass through, and, being lighted at the upper ends of the pipes, it burns continually, and thus is destroyed. But when it is permitted, by neglect or ignorance, to accumulate in the high galleries, (to which its extreme levity carries it,) as soon as the flame of a lamp touches it, the whole explodes like gunpowder, and spreads ruin and death around. Last year, in one of the newly worked mines in Chesterfield, this occurred, to such effect, as to cause the work to be stopped, and the value of the property to be lost—at least for the present time.

The seam of coal in the pit which I visited was about ten feet thick. The body here is divided by the interposition of a layer of slate (thirty or forty feet thick) into two seams—and in some mines there are many such separate seams, of various thickness. Seams not more than four feet thick are worked. In some places the interposed slate runs out, and the different seams of coal unite. Such is the case in one shaft of this tract, (now unfortunately under water,) where the solid coal was forty-seven thick; and in Chesterfield, in Wooldridge's pit, it was more than fifty feet thick, and in Heth's, still more. Neither of these mines are now worked; but other shafts are now sinking to the same thick seam, which is reached at the depth of about six hundred feet. The operation is these very deep mines, and in such thick seams, are far more interesting than such as I saw, and which I should have been glad to witness. In them, the coal is blasted by gunpowder, instead of being dug by picks and by hand labor entirely—the loaded sleds are drawn by mules to the shaft—and thence steam engines draw the coal up to the surface.

Where the coal is in two separate seams, the upper is first worked, over a sufficient space, and then that beneath s taken out, in like manner, not affected by the filling in, which is still in progress, or finished, of the seam above.

It was on this property that the singular accident occurred about two years ago, of filling the whole of a working of the upper seam with water from James River. The mines were then rented out; and the tenant sunk a shaft in the low-ground near the river, and actually extended his excavation under the river, where it is perhaps two hundred yards wide, until within twenty-nine yards of the opposite bank. Still it would have been safe; but for the pillars being left too weak, and the settling of the roof permitting the water above to find entrance, and of course overflowing the works.

After coming out of the pit, I saw the manner in which the coal is carried to the boats on the canal. For this object, the design is very good, and the facilities great—but the execution though recently much improved, is very bad.

A railway has been made from each of the two working shafts to the canal. From the highest, the railway has just been continued across the canal and low-ground to the river—the whole of it being about 600 yards in length. This continuation will permit boats to be loaded when the canal navigation is interrupted, which has been frequently the case, to the great loss of the colliers. The descent will permit the cars of coal to run ra-

pidly the whole distance to the canal—and to the river when required—by the force of gravity alone. The cars carry twenty-seven bushels of coal. Mules are quickly attached at either end. The railway extends on long beams, which turn on a hinge or pivot, over the canal. At the end, there are strong bars of iron curved to fit against and to stop the wheels of the car, and the beams are prevented from yielding to the weight of the car by being confined by a rope. The end of the car (or tail-board,) is held by hinges at top, and is kept close by an iron bar, or latch, extending quite across, and fitting into catches at both ends. When in its place, the rope is cut loose, the outer ends of the railway-beams sink, with the car, so as to be considerably inclined; and the latch is struck, and the pressure of the coal against the tail-board throws it open at bottom, and the load slides out into the boat, which had been placed below.

The railway string-pieces are made of scantling four inches by five, and without any iron where the road is straight. Thin iron is on the rails through the length of a curve made to the shaft. I should suppose that there would have been *economy* in having the whole railway lightly ironed, both to prevent wearing away the angles of the rails, and to keep the cars more securely on the track.

The inclination of the railway is so steep that it is necessary to expend considerable power, on part of the route, to retard the rapidity of the cars, by a mechanical contrivance, to regulate which (and to empty the load) a man rides down on the car. On one occasion, the man became alarmed, and leaped off, leaving the car to run down without the usual and necessary obstruction, and such was its acquired velocity, that it bent one, and broke off the other of the strong iron bars, intended to stop its course, and leaped across the canal, without touching the water, and stuck into the bank on which it struck. If the inclination of the railway was better graduated, and a straight course adhered to throughout, it would be quite practicable, on a double track, to make the descent of the loaded cars operate to bring back the empty ones, and so dispense with any other power than gravity. Or if this plan was not simple enough, and mule-power was still preferred to bring back the cars, and hand-power to retard the descent of the loads, still it might be so fixed (as at the Mauch Chunk mines in Pennsylvania,) that the mules might *ride down*, on the loaded car, so as to be on the spot to return immediately with the car, as soon as emptied. This would save half the travel of the mules, prevent all delay in waiting for their arrival, and also the need for the hand who now rides them down to the canal, or river.

As farming is not the main business of the proprietors of this naturally fertile tract of land, and moreover, (as one of them said to me,) as colliers are to a proverb negligent of every source of comfort, and of profit, except the coal or ore they are in pursuit of, it would be out of place here to describe or criticise the agricultural operations of this estate. It is enough to say, that the farming operations, and state of the farm, present, in all respects, the most perfect contrast imaginable to those of the proprietors' near neighbor Richard Sampson. But, on the other hand, my friend A. assures me that his management is capital on his fine estate on the Appomattox, where farming is the sole object; and that he means to do wonders there next year, and thereafter, as a live-stock breeder and grazier—all of which operations I hope hereafter to see, and to award to them due credit and praise.

There was however one ditching operation of Mr. Anderson's, on a large scale, which well deserves notice, and imitation, under similar circumstances. An excellent saw and corn mill is turned by water drawn from the canal, at an annual rent. The fall is twenty-two feet, and of course it was necessary to dig a canal, or race, as deep, from the mill-wheel to the river, several hundred yards. This would have been a heavy job, if executed by spades and barrows; but was effected with great ease, in the following manner. The track was laid off, ten feet wide, and well coultered by a team of oxen. Water was then turned on from the canal, in sufficient quantity, and the current soon swept a passage along the coultered surface, and carried off all the earth as low as it had been well loosened, into the river. The coultering was then begun again, upon the sub-soil, and the current of water being still kept flowing, it washed away every slice almost as fast as it was loosened by the coulter. In this manner, the layers of cutting or digging were made entirely by the coulter, to the full depth required, and the current of water served for the whole lifting and removing-power. It being in summer, the flow of water was not hurtful to the team, or ploughman. The sides of the canal were thus carried down as nearly perpendicular as possible, but they have since crumbled in, so as to be sufficiently sloped, and to have width enough at top, the water from the mill serving to carry off all the crumbled earth as fast as necessary.

There was another excavation in progress, which attracted my notice particularly. This was a tunnel which was intended to pass through a hill, for the purpose of leading pure water from a well, to supply the steam engine. The water drawn from the coal mine cannot be used for this purpose, as it is strongly impregnated by copperas, and would corrode the boilers—and indeed all the water from wells and springs over the bed of coal is vitiated in like manner, though in but a slight degree. When I went into the tunnel, as far as finished, it had reached thirty-seven yards under the hill. It was dug horizontally through clay, and sometimes through sandy and water-yielding earth, about four and a half feet high, and four wide. The man who was digging it advanced the work three feet a day, gearing as he proceeded, as is done in the galleries through the coal. He worked, generally, seated on a low stool, and with a short and light pick, the cutting ends of which were chisel-shaped, and not more than half an inch wide. With this pick, he cuts in about two feet, a narrow opening at the bottom of the tunnel, and the whole width across; then makes a similar narrow perpendicular cut at one side; and then, by striking in wedges, brings down the earth, thus undermined, in large masses. Another hand draws out the earth in a coal-corve. The examination of this tunnelling satisfied me of the practicability and safety with which a like work might be executed through solid marl, wherever required by the great thickness of, and labor otherwise necessary for removing the superincumbent earth.

Still, this operation is so slow, that it would be cheaper to dig away twenty feet of over-lying earth, rather than to tunnel beneath it. Notwithstanding, the knowledge of this process, and, still more, of the mode before described of discharging the cars of coal into boats, may be perhaps advantageously applied to the loading vessels with marl on tide water, when that becomes a business worth pursuing—as it certainly will be, at some future time.

[To be continued in No. 6.]

AGRICULTURAL EXCURSIONS.

We have commenced, and intend to continue to make excursions into the country, to such extent as future circumstances may permit and encourage, for the purpose of seeing and making notes of the state of agriculture, and of other sources of the wealth and prosperity of different parts of the country. We would greatly prefer that this service should be performed by other and better hands—not only because of the unceasing demands on our labor and attention, and our publication and other business at home, but still more because no *new observer* can possibly understand, and report on, either fully or correctly, matters so little known before, and so hastily glanced over.

SEASON AND STATE OF CROPS.

Our opinions, given in the two last numbers of the Farmer's Register, as to the amount of the wheat crop, have been confirmed by the latest and most authentic accounts, though previously contradicted on all sides, by newspaper statements of the large crop supposed to have been made, throughout the country. The crop will certainly prove to be less than an average amount. The quality of the grain is most excellent.

We have never known such variety of condition in the growing crops of Virginia, so far as heard from, in regard to the effects of abundance, or of want of rain —and especially as to corn. The supply of rain has been extremely irregular, and partial—many farms and small neighborhoods, in different parts of the state, having suffered extremely with drought, while there fell plenty of rain within a few miles. But though this state of things is calculated to cause very contradictory reports, and many bad reports, (as the sufferers always complain more loudly than others rejoice,) still we hope and believe, that on the whole, the general product of corn will be plentiful. Our opinions as to this prospect, are not founded on very extensive information; but they may be perhaps counted of something more in value, in as much as we are personally among the heaviest sufferers by long-continued drought. The rains latterly have been abundant every where—but were too late to prevent greatly reduced products, where drought had been most injurious.

The following is the most unfavorable account received of the wheat crop, and from part of the finest wheat region of Virginia.

"*Albemarle, Aug. 10th.*

"We have experienced another disastrous season for the wheat crop. It is my opinion that the product in this county did not exceed more than half an average crop. I know others estimate it as a larger proportion. The quality of the grain is generally good; but portions of a great many crops were seriously injured by the rust, both in quality and quantity.

The corn crop was exceedingly promising until the early part of July. We then experienced a severe drought of four weeks, at the most critical season, which, I think, will materially affect the abundant product previously anticipated. We have lately had fine showers of rain, and the improvement in the appearance of the corn is very considerable. I have never before seen the beneficial effects of deep and timely culture made more manifest, than in the present corn crop. It is almost astonishing to observe the difference, on lands of equal quality, of that which received deep, and that which received shallow cultivation. Our crops of oats have yielded large products. The meadows have also been very productive, and a fine crop of hay has been well secured."

PLUMBAGO, (OR BLACK LEAD) IN NORTH CAROLINA AND VIRGINIA.

It was lately stated in the English papers, that the celebrated mine of plumbago, or black lead, at Borrowdale, in England, was exhausted, and that no other source of obtaining this useful mineral was known. It has since been stated in some of the papers of this country, that plumbago can be obtained in any quantity in the vicinity of *Raleigh* in *North Carolina*. To confirm the statement, we have pleasure in publishing the following extract from a geological report made to the legislature of North Carolina several years ago, by Professor *Olmstead*, then professor of chemistry and minerology, at the University of that state, and at present, professor of mathematics in Yale College.

"This great deposite of black lead," says the professor, "lies a little westward of *Raleigh*. The whole formation consists of a great number of parallel beds, varying in width from a few inches to twenty feet. They lie in a singular variety of isinglass rock, *(micaceous schistus,)* usually of a bright cherry-red, but sometimes of a silvery white color .These beds occur throughout a space not less than three-fourths of a mile wide, and ten miles long. I have never read of any mine of plumbago, which can compare in extent with this, and have reason to believe it is the largest mine on record."—[*Nat. Int.*]

I have lately seen it stated in several newspapers that the black lead mine in England which had been so long worked had failed; and that no other mine of that mineral was known.

There is in the county of Amelia, state of Virginia, upon the lands of Mr. E. F. Eggleston (at a place called Wintersham,) about two miles north of the court-house, a black lead mine.—Some fifty or sixty years ago it was worked; that is, it was dug into and black lead obtained. Small quantities were left upon the surface of the pit. The writer has often seen and used it. It marks well. It is the same mine mentioned by Mr. Jefferson, in his Notes on Virginia. Possibly it might now be worked with profit.

If Professor Rogers will extend his observations into this county, he will find subjects well worthy his attention.

Amelia County, 10th August, 1837.—[*Whig.*]

MONTHLY COMMERCIAL REPORT.

There is some little animation in business this month, particularly in Virginia; supplies of tobacco have increased, and large sales are daily made at the inspections, at all prices from $2 50 to $7 50. The deficiency in the receipts, compared with those of last season, will be considerably reduced by the 1st October. The growing crop is said to be late.

Wheat is brought in freely, and commands a ready sale at $1 40 to $1 45. The quality is unusually fine, but the quantity is not considered large. There is scarcely any demand for flour for export, and the price may be quoted about $8—dull and declining.

Corn has declined to 80 a 85 cents, and will be much lower when the new crop is nearly ready for market, as it promises to be more abundant than any we have had for several years.

The demand for cotton is chiefly confined to the wants of our own mills. The stock on hand, (about 3000 bales,) embraces little of good quality. Some of the best has recently been sold at 10½ to 11 cents; but the greater portion of it is unsaleable, unless at a much lower price. The preceding remarks apply to the Virginia markets. One bale of the new crop has been received at New Orleans.

The gloom which has so long prevailed in the commercial world is partially dispelled; but the derangement of exchanges still continues, and the currency of the country consists of every thing except specie. The only substitute for it in payments to the general government is a new sort of currency, issued by its own officers in the shape of treasury drafts, or checks on its deposite banks, which are protested, if specie be demanded for them. These treasury drafts command a premium of 5 to 6 per cent., for the purpose of paying duty bonds.

Specie in New York is at 9 to 11, and exchange on London 19 to 21 per cent. premium. Large exports of specie are consequently made.

In Mobile, specie is at 18, New Orleans bills 5, and United States Bank bills 12 per cent. premium, while Mississippi bills are at 25 per cent. discount.

In Virginia, the difference of exchange on the north is 1 per cent.: few small bills have got into circulation here. We are not yet inundated with those of five to fifty cents, as is the case elsewhere; but great inconvenience is experienced for the want of small change.

The pressure for money is much less than it was some weeks or months ago. The amount of engagements has been greatly reduced, and a vast amount remains under protest.

The action of Congress, now about to convene, is looked to with anxiety, but without much confidence in the adoption of practical and permanent measures for the restoration of the currency. The banks of New York invite those of other states to a conference, at which, plans may be suggested for the resumption of specie payments.

X.

August 26.

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